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bulletin

NEWS AND VIEWS IN THE BIOLOGICAL SCIENCES

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EDITORIAL

Challenge and Satisfaction

PAUL B. SEARS

IT is not an uncommon experience to meet men in late life who have been, somehow, disillusioned during the course of their careers. How many more keep it to themselves, there is no way of knowing. But it is, I believe, worth recording that one does not encounter biologists disillusioned with respect to their choice of profession. You may find individuals who have been frustrated by the vagaries of university or industrial politics, or defeated by their own limitations. Yet I doubt whether the most despondent of these latter would fail to light up when confronted by some challenging biological phenomenon.

The nearest approach to abject indifference was a predecessor of mine who had twice seen his priceless collections destroyed by fire. This was the late Dr. H. H. van Fleet, who had scoured Oklahoma before the days of easy transport, while many remnants of its rich virgin flora remained. I never met him, but it is clear that his final apathy came, not from distaste, but from his intense and defeated love for his subject.

The law of normal frequency being what it is (checked by a glance at the scientific directories) most students now weighing a choice of careers are associated with teachers who are in mid-voyage. Such teachers—why conceal the facts?—are naturally concerned to win converts. Students are not stupid and often they sense this. When they do, it may lead them to discount the merits of the situation, for the exceptional student is in much the same situation as a man in the market place with a pocket full of gold and no automobile or life insurance. He is a most desirable prospect.

As a precaution, it might be well for the young man or woman who is weighing the future to have a borrowed look backward. It has been my privilege to have been associated with several great biologists at times when their active careers were drawing to a close. Without exception, these men retained the eager, almost boyish, appetite for their profession which they had at the beginning.

John M. Coulter called it "the delirious but divine desire to know." Charles E. Bessey spoke of it as "keeping your mind in a meristematic state." John H. Schaffner, whose greatness, concealed by personal diffidence, still remains to be appreciated, and R. A. Harper, manifested it in the most casual personal contact. So did William Bateson, who, within three years of the end, renounced an ancient prejudice and gave warm welcome to the evidence of Morgan and his students.

I can think of at least six other men, still happily among us, who are old by the calendar. Their bodies have aged, but when I am with them, I never think of them as old men, and I doubt if they waste much time thinking of themselves in such terms. They are still, despite the limitations of nature, eager students of living organisms, and there is no reason to suppose that it is conceivable to any of them that he would have chosen to be anything else. Their enthusiasm "the god within" has lasted, and will last so long as they are physically and mentally capable of any interest in the world around them. The real test of a battle is the way it looks to a general after it is pretty well over.

It is, I think, an open secret that students of the highest intellectual capacity, with few exceptions, go into fields which seem to be the most difficult and exacting. On this basis, biological science has of late suffered by comparison with, say, theoretical physics. Actually, the old formula which holds for matrimony or the priesthood applies just as well in the choice of science—follow your heart, and if there is any doubt, do something else.

Any really capable young scientist could do about equally well in any of several fields. What counts is his intuitive liking for certain kinds of phenomena and problems. Here he should exercise the freest choice, and be most honest with himself. In particular, if he likes to work with plants and animals, but has the idea that the fundamental challenges of science lie elsewhere, let him be promptly undeceived. Science today faces no more profound or difficult problem than that of form, or organization, and the answer to it must be sought in living organisms. However impressive the labors of physical science, they will in the end be but the tools which must serve those who seek to penetrate the riddle of life.

So—follow your heart—and if it leads you towards biology you may be reasonably sure that those who have preceded you have no regrets of record, and that the profession of your choice holds a challenge to the highest of man's capacities.

Across the Editor's Desk

• **The Department of Biological Sciences at Stanford University** announces the establishment of a limited number of **Eli Lilly Fellowships in Biology.** These will be awarded to students at the pre-doctoral level, at stipends ranging from $1,000 to $2,000. Inquiries and applications should be addressed to Dr. V. C. Twitty, Chairman of the Department.

❖

• **M. T. Carpenter,** Administrative Director, Standard Oil Company of Indiana, **has been elected President of the Scientific Manpower Commission for 1954,** succeeding Howard A. Meyerhoff, the Commission's first president. Dr. Meyerhoff will continue to direct SMC activities, under the title of Executive Director. Mr. Carpenter is also Chairman of the American Chemical Society's Committee on Manpower and will retain this post in 1954. Other new officers named in the election that has just been completed are John S. Nicholas, of Yale University, succeeding E. G. Begle, of the same institution, as Vice-President; and Dael Wolfle, of the National Research Council Commission on Human Resources and Advanced Training, who will take over the responsibilities of Secretary-Treasurer from Milton O. Lee. Dr. Lee and B. R. Stanerson, of the American Chemical Society, will continue to serve as Executive Board members. The Commission voted unanimously for cooperation with the Engineering Manpower Commission of Engineers Joint Council (N. Y.) on all manpower matters of common interest and the *EMC Newsletter*, now circulated by the engineering organization, will become a joint publication of the two commissions with the first issue of 1954.

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• **The VIII International Congress of the International Society for Cell Biology** (Cytology Congress) will be held in Leiden, Holland, September 1-7, 1954. Officers of the Society are: President: E. Newton Harvey, Princeton University; Past President: J. Runnström, Wenner-Grens Institute, Stockholm; Vice-President: E. Faure-Fremiet, Laboratoire d'Embryogenie Comparee, Paris; Secretary-Treasurer: J. F. Danielli, King's College, London; Assistant-Treasurer in the U. S. A.: J. S. Nicholas, Yale University. Prof. P. J. Gaillard of the Laboratory for Experimental Histology of the University of Leiden is Chairman of the Dutch Committee. Correspondence should be addressed to the Secretary, Dr. W. H. K. Karstens, Botanical Laboratory, State University, Nonnensteig 3, Leiden.

Full members of the Society, and candidates for membership approved by the International Committee, are automatically entitled to attend the Congress, and to introduce one guest. The International Committee has prepared a program of symposia including the following topics: Induced enzyme synthesis; the formation of the intracellular matrix in plant and animal tissues; (open: to be filled by Dutch Committee); biochemistry of gene action; thyroid secretion; nuclear and chromosome structure; mitochondria; cell division and mitotic poisons; morphogenetic interactions between cells; virus synthesis; the active cell surface; submicroscopic structure of cytoplasm. Speakers will be announced by the Dutch Committee at a later date. There will be no programs of general papers but members and invited guests may contribute a paper to be read by title, if accompanied by an abstract of 300-400 words. These abstracts will be published before the Congress, and should be sent as soon as possible to the Secretary of the Dutch Committee.

• The establishment of a **National Science Foundation Advisory Committee to consider the effects of government support of colleges and universities on their research and teaching functions** was announced recently by the Director, Dr. Alan T. Waterman. Chairman of the Committee is Chester I. Barnard and the members are: Arthur S. Adams (President, American Council on Education), Vannevar Bush (President, Carnegie Institution of Washington), James S. Coles (President, Bowdoin College), Harold W. Dodds (President, Princeton University), Conrad A. Elvehjem (Dean of Graduate School, University of Wisconsin), T. Keith Glennan (President, Case Institute of Technology), Virgil M. Hancher (President, State University of Iowa), William V. Houston (President, Rice Institute), Clark Kerr (Chancellor, University of California, Berkeley), C. N. H. Long (Professor of Physiology, Yale University), Don Price (Associate Director, The Ford Foundation), Julius A. Stratton (Provost, Massachusetts Institute of Technology).

Those concerned with higher education have long recognized that the extent and scope of financing by government of development projects and research in universities and colleges raises some important questions about the effects of such funds upon the customary teaching and research activities of the institutions. During the year ending June 30, 1952, educational institutions received almost $300 million from Federal agencies for development and research.

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• **The Department of Biological Sciences, University of Delaware, announces a program of graduate study leading to the Ph.D. degree** in the biological sciences. General areas of graduate instruction and research in the department are: bacteriology; botany, including plant physiology; marine biology, including ichthyology and estuarine studies; general and cellular physiology; and zoology, including invertebrate zoology, embryology and genetics. Inquiries concerning details of the program and graduate fellowships and assistantships should be directed to Dr. James C. Kakavas, Chairman, Department of Biological Sciences, University of Delaware, Newark, Delaware.

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• **Scientific visitors to the United States** whose itineraries might be of interest to biologists include:

Dr. Gustav Asboe-Hansen, Laboratory for Connective Tissue Research, University Institute of Medical Anatomy, University of Copenhagen, arrives in U. S. February 15, 1954 and departs March 30, 1954. Dr. Asboe-Hansen plans to attend the Fifth Conference on Connective Tissues at Princeton. Possible lecture topics: Hormonal Effects on Connective Tissues; The Mast Cell—Morphology and Physiology. May be contacted through the Josiah Macy, Jr. Foundation, New York City.

Professor A. V. Hill, F.R.S., Honorary Research Associate, University of London; Secretary General, International Council of Scientific Unions. Attending Columbia University in Bicentennial, Dec. 20-Jan. 20. Also the annual meeting of the AAAS in Boston.

Professor H. A. Krebs, M.D., F.R.S., Professor of Biochemistry, University of Sheffield, and Director of the Medical Research Council Unit for Research on Cell Metabolism. From the end of February 1954 to April 1954 he will lecture at Johns Hopkins University, and the Universities of Chicago and Wisconsin.

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• **The National Science Foundation will award individual grants** to partially defray travel expenses of a limited number of American scientists who will attend: *The Third Congress of the International Association of Gerontology* to be held in London, England, July 19-23, 1954; *The Eighth Congress of the International Society for Cell Biology* to be held in Leiden, Netherlands, September 2-9, 1954. Blanks whereby

applications for grants may be made, may be obtained from the National Science Foundation, Washington 25, D. C. Completed applications must be returned to the Foundation by February 15, 1954 in order to permit time for evaluation and processing. Announcements of the travel grants to be awarded will be made in March 1954.

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• **A predoctoral fellowship of $1,400 is being offered by Sigma Delta Epsilon,** Graduate Women's Scientific Fraternity. Applications for the year 1954-55 should be submitted before February 1, 1954 to the Fellowship Board, authorized to make the award of the fifth Fellowship. Women with the equivalent of a Master's degree, carrying on research in the mathematical, physical, or biological sciences, who need financial assistance to complete work for the doctorate and give evidence of high ability and promise are eligible. During the term of her appointment the appointee must devote the major part of her time to the approved research project, and not engage in other work for remuneration (unless such work shall have received the written approval of the Board before the award of the fellowship). Application blanks may be secured from Dr. Esther S. Anderson, Geography Department, University of Nebraska, Lincoln 8, Nebraska. Announcement of the award will be made early in March 1954.

❖

• **The Office of Naval Research and the University of Pennsylvania have announced a symposium on "Origins of Drug Resistance,"** to be held March 25-27, 1954 at the Hotel Statler in Washington, D. C. Five sections are planned: "Origins of Drug Resistance in Microorganisms," "Effects of Acridines and Resistance to Insecticides and Herbicides," "Origins of Tolerance and Addiction to Drugs, and Alcoholism," "Resistance Factors in Infectious Agents and Cancer Cells," "Physiological, Chemical and Genetic Viewpoints." Speakers will include: H. B. Newcombe, V. Bryson, W. Szybalski, Harriett Ephrussi, A. C. R. Dean, B. Ephrussi, Charles E. Minarik, Richard Kuhn, Leigh E. Chadwick, Nathan B. Eddy, J. H. Quastel, Ebbe C. Hoff, Roger J. Williams, Lloyd W. Law, James A. Miller, Elizabeth C. Miller, Morris K. Barrett, Howard A. Schneider, Herschel K. Mitchell, M. G. Sevag, and Ralph W. Gerard. The speaker at the banquet will be Prof. C. P. Martin, McGill University, Montreal, Canada, who will address the group on "Theories of the Mechanism of Evolution."

Further information about the symposium may be obtained by writing: Dr. M. G. Sevag, Department of Microbiology, School of Medicine, University of Pennsylvania, Philadelphia 4, Pa.

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• **American Phytopathological Society**
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• **American Ornithologists' Union**
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Treasurer: Charles G. Sibley
Secretary: Harold Mayfield, 2557 Portsmouth Ave., Toledo 13, Ohio.

• **Potato Association of America**
President: J. H. Muncie
Vice-President: Arthur Hawkins
Treasurer: John C. Campbell
Secretary: R. W. Hougas, University of Wisconsin, Madison 6, Wisconsin.

• **The American Association of Anatomists** will hold its 67th meeting at the University of Texas, Galveston, Texas, April 7-9, 1954. Titles and abstracts of papers, demonstrations, and motion pictures must be mailed to Dr. Normand L. Hoerr, Secretary, Western Reserve University, 2109 Adelbert Road, Cleveland 6, Ohio, not later than January 11, 1954. Members will automatically receive a copy of the abstracts. Additional copies may be obtained directly from The Wistar Institute of Anatomy and Biology, 36th Street, and Woodland Avenue, Philadelphia 4, Pa., at 75 cents a copy, payable in advance. Further information, regarding hotel reservations, preparations of abstracts, etc., may be obtained by writing to the Secretary.

• **The Association of Southeastern Biologists** will hold its 15th Annual Meeting at Louisiana State University in Baton Rouge, April 15-17, 1954. The Association is composed of more than 500 biologists from southern colleges, universities and research institutions. Dr. Bruce D. Reynolds of the University of Virginia is President for 1954. In addition to papers contributed by the members there will be a symposium on Marine Biology and a session on Biology Teaching. Field trips are being arranged in cooperation with the Southeastern Section of the Botanical Society of America and Southern Appalachian Botanical Club.

• **Dr. Frank Pitelka** of the Museum of Vertebrate Zoology of the University of California at Berkeley was named as **this year's recipient of the George Mercer Award** at the annual dinner of the Ecological Society of America at Madison, Wisconsin. This award is made annually for an outstanding paper in the field of ecology. It was established by an anonymous donor in memory of Lt. George Mercer of the British Army of World War I, who was a promising young naturalist and ecologist. The award consists of a plaque and the sum of one hundred dollars. Dr. Pitelka's outstanding contribution is a paper entitled, "Ecologic overlap and interspecific strife in breeding populations of the Anna and Allen hummingbirds."

• **The Ecological Society of America** announces the publication of the ***Thirty Year Index to Ecology*** (Volumes 1-30, 1920-49). This is the result of the collaboration of committee members and a host of indexers and is a remarkably complete product. It includes entries such as the following: authors, titles of articles, significant words in titles and text, names of organisms, geographic locations, instruments, methods, illustrations, maps, notes, and reviews. This index is a 212-page volume, paper bound, and priced at $4.00. It may be purchased from Dr. H. J. Oosting, Box 6875, College Station, Duke University, Durham, North Carolina. It will be sent postage free, if payment accompanies order. Make checks payable to the Ecological Society of America.

• **The annual meeting of the Society of General Physiologists** was held at Woods Hole, September 11-12, 1953. One day was devoted to contributed papers and one to a symposium on "Photoperiodism," arranged by Sterling B. Hendricks, in cooperation with the Committee on Photobiology, National Research Council. Officers elected for 1953-54 were announced during the meeting: President: Arthur K. Parpart, Princeton; Vice-President: Frank A. Brown, Jr., Northwestern; Secretary-Treasurer: John B. Buck, National Institutes of Health. New Council Members are: D. R. Griffin, Harvard; W. D. McElroy, Johns Hopkins. AIBS representative is W. R. Duryee, National Cancer Institute. It was voted to affiliate with the AAAS and the representatives selected are: H. B. Steinbach, Minnesota, and L. R. Blinks, Stanford. F. A. Brown, Jr. and Folke Skoog were nominated for associate editorship of *Physiological Reviews.* In voting on places for future meetings, Woods Hole won narrowly over Gainesville for 1954, and it was also decided to meet at Woods Hole in 1955 in conjunction with the meeting of the American Physiological Society at Tufts Medical School. The society is a member of the International Union of Physiological Sciences, and the members entitled to participate in the next Congress.

• **The Society of Protozoologists announces a new journal** devoted to the study of the protozoa. The first number will be a Woodruff Memorial Issue, sponsored by the Woodruff Memorial Committee, Yale University, and will consist of contributions by former students and colleagues of the late Professor Lorande L. Woodruff. The second number is scheduled to appear in May 1954. Papers for this and subsequent issues may now be submitted to the Editor.

The Journal of Protozoology, four issues per year, is designed for the publication of the results of original work, of either descriptive or experimental nature, in the field of protozoology. It will cut across interdisciplinary lines and provide a common medium for the taxonomist and the physiologist, the parasitologist and the biochemist, working with protozoan material. Papers submitted for publication should be sent to the Editor, Dr. William Trager, The Rockefeller Institute for Medical Research, 66th St. and York Avenue, New York 21, N. Y. Subscription to the *Journal of Protozoology* is included in the membership dues of the Society. The annual dues are $9.00 for all except graduate students, for whom they are $6.00. The price of subscription to the journal by individuals not members of the Society and by libraries and institutions is $9.00 per year. Application blanks for membership in the Society may be secured from the Secretary, Dr. Norman D. Levine, College of Veterinary Medicine, University of Illinois, Urbana, Ill. Communications regarding subscriptions by non-members should be addressed to the Treasurer, Dr. Reginald D. Manwell, Zoology Department, Syracuse University, Syracuse, N. Y.

• **William C. Steere,** Stanford professor and internationally known botanist, has accepted an invitation to serve as President of the Eighth International Botanical Congress to be held in Paris, France in July 1954. Dr. Steere is also president of the California Botanical Society, and the Pacific Section of the Botanical Society of America. He is also editor-in-chief of two professional journals, the *American Journal of Botany* and the *Bryologist.*

• At the annual meetings held in September at the University of Wisconsin, the **Botanical Society of America** voted to publish on a trial basis for a year, an informal *Plant Science News.* Such a medium will enable the Society to communicate with its members about Society business, to inform its members of the availability of special fellowships and research grants, academic prizes and awards and to provide a place for the discussion of any matters of interest to botanists concerning the profession, the teaching of botany and biology, and the implications of plant science in contemporary affairs. The Editorial Board is headed by Harry J. Fuller, University of Illinois, and aided by George S. Avery, Jr., Brooklyn Botanic Garden, Harlan P. Banks, Cornell University, Harriet B. Creighton, Wellesley College, Sydney S. Greenfield, Rutgers (Newark Colleges) and Paul B. Sears, Yale University.

Interest in the VIIIth International Botanical Congress to be held in Paris, July 2-14, 1954, led the Society to vote to ask its members for voluntary contributions to supplement travel aid grants that will be made by the National Science Foundation. It is hoped that enough people who cannot attend will contribute an amount sufficient to help two or three others to go.

The A.I.B.S. Reports

• **Three AIBS Advisory Committees to the Office of Naval Research** met during November and early December. On November 7, the Physiology Committee met at the AIBS office in Washington. The Biochemistry Committee met at the Office of Naval Research on November 13. The Physiological Psychology Committee met for the first time as an AIBS committee at the Harvard Psycho-acoustic Laboratory in Cambridge, December 4 and 5.

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• **Dr. J. R. Porter,** Chairman of the Department of Bacteriology, School of Medicine, University of Iowa, **has been appointed Chairman of the Office of Naval Research Advisory Panel for Microbiology.** Other members of this Advisory Panel are: W. J. Cromartie, University of North Carolina; N. F. Conant, Duke University; Emil Mrak, University of California; H. R. Morgan, University of Rochester; W. J. McElroy, The Johns Hopkins University; and H. P. Treffers, Yale University. The fall meeting of the Panel was held in Washington, D. C. on December 7 and 8. Applications for the support of research in the field of microbiology were reviewed at that time.

The program of the Microbiology Branch of the ONR includes projects in bacteriology, virology, parasitology, mycology, and immunology. At present this branch has under supervision nearly 90 contracts with 52 universities in 29 states. The investigations supported by these contracts deal with fundamental aspects of problems of importance to the Navy and the defense of the nation.

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• **Paul J. Kramer,** Department of Botany, Duke University, has been elected representative of the American Society of Plant Physiologists to the Governing Board of the AIBS.

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• **The Directory of Hydrobiological Laboratories and Personnel of North America,** prepared by the AIBS Hydrobiology Committee to the Office of Naval Research, is being published by the University of Hawaii Press on May 1, 1954. There are 187 laboratories listed and for each laboratory the address, senior officer, institutional affiliation, objectives, scope of activities, season of operation and environments stressed are included. For the visiting investigator it indicates the accommodations available, major research facilities, capital equipment and provisions for publication. For the prospective student the instructional program, teaching facilities and scientific staff are listed. Also included are biographical sketches of 1,300 personnel, giving the institutional affiliations, mailing address, field of specialization, current research project and field experience by geographic regions. The Directory will contain about 300 pages, and include 22 photographs, 4 charts and one map.

The December issue of the **AIBS PLACEMENT SERVICE LIST** has just been published. Copies of this list may be obtained from the AIBS office at a cost of $1.00 each. Some 135 registrants are listed in 18 fields of biological sciences.

The Spring issue of the Placement List—scheduled to appear in June—is now being prepared. Biologists who wish to be included are urged to register as soon as possible. For information and registration blanks write: Placement Service, American Institute of Biological Sciences, 2101 Constitution Avenue, Washington 25, D. C.

The Biology Library

One copy of each publication submitted for listing should be sent to the Editor, The AIBS Bulletin, 2101 Constitution Avenue, Washington, D. C. Only books published within a year of receipt will be reviewed. Older books will be listed.

ANIMAL SCIENCES

The Mammals of Minnesota. HARVEY L. GUNDERSON and J. R. BEER. 190 pages, distribution maps and photographs. University of Minnesota Press, Minneapolis 14, Minn. (1953) $3.50 cloth; $2.00 paper.

The material in this book is based primarily on the collections in the Museum of Natural History and the Division of Entomology and Economic Zoology of the University of Minnesota. The authors are members, respectively, of these departments. Eighty-one different kinds of mammals have been identified within the borders of the state; each species is described, keys to its classification given and the distribution county by county, shown on maps. This publication, however, is not intended to be a complete treatise. Since earlier publication about the mammals of the region are no longer in print, the authors considered a new handbook desirable. By combining pertinent material from the earlier publications with recent information, the book becomes an accurate, popular manual that can be used by schools, conservation groups, hunters, trappers and all others interested in Minnesota's natural history.

PLANT SCIENCES

The Ferns and Fern-Allies of Maryland and Delaware including District of Columbia. CLYDE F. REED. 286 pages, 271 illustrations, 58 maps. Reed Herbarium, Baltimore, Maryland. (1953) $3.00.

Frankly directed at the amateur as well as the professional botanist this handbook is, according to the author, "the first authentic book to classify and illustrate the ferns and fern-allies in Maryland, Delaware and the District of Columbia." As such it is a valuable aid to the botanist interested in the pteridophytes of that area. An introduction explains the scope of the book and the use of the keys, maps and illustrations. A short history of the study of pteridophytes in the region is followed by a discussion of distributional characteristics of the region's fern flora. The description of leptosporangiate fern life cycles and of the anatomy of a "typical" fern sporophyte will be helpful to the amateur. A key to families, genera and species is provided. Descriptions of species are semi-technical in nature and illustrations accompany the more important species. Distribution maps further facilitate identification. A glossary, bibliography, and index to scientific names and common names complete this very useful handbook.

Fundamentals of Ecology. EUGENE P. ODUM. 384 pages, 119 figures. W. B. Saunders Company, West Washington Square, Philadelphia, Pa. (1953).

Dr. Odum, who teaches at the University of Georgia, has written a book that is intended "to serve as a textbook in a college course, and also as a reference for the naturalist and for the interested workers in related fields, including the great and growing army of conservation workers, sanitary engineers, and other applied ecologists who need to be familiar with background work and theories in ecology."

The author has tried four "approaches" to ecology in his teaching: the "factor," the "level," the "principles" and the "environmental" approaches. He discovered that the first two were much less effective for the average student than a combination of the last two. The book has been written with this experience in mind and attempts, as well, to balance the three main facets emphasized in modern ecology: autecology, population and community ecology, and trophodynamic and ecosystem ecology.

Advance in Agronomy. Volume V. Edited by A. G. NORMAN. 422 pages, illustrated. Academic Press Inc., 125 East 23rd Street, New York, N. Y. (1953) $8.80.

Fourteen outstanding agronomists have contributed to this fifth volume of the "Advances in Agronomy" series. A new departure in the series is a review of the history of the establishment of a major crop—wheat in the United States. In addition there are comprehensive reviews of the soil organic fraction, progress in agricultural engineering, chemical weathering of minerals in soils, the changing pattern of agronomy and horticulture in Canada, and soil management for conservation and productivity.

The Metabolism of Algae. G. E. FOGG. 149 pages, 20 diagrams. John Wiley & Sons, Inc., 440 Fourth Avenue, New York, N. Y. (1953) $2.00.

In this small book Dr. Fogg has brought together the basic information necessary to an understanding of algal metabolism. Numerous genera in all major groups of algae are discussed in relation to method of carbon assimilation—and, therefore, energy absorption, and to the products of their metabolism. An extensive bibliography, with references to much unpublished work, is included.

MISCELLANEOUS

Adaptation in Microorganisms. (Microbiology Symposium III). Edited by E. F. GALE and R. DAVIES. 339 pages. Cambridge University Press, 32 East 57th Street, New York 22, N. Y. (1953) $6.00.

The Society for General Microbiology sponsored this Third Symposium, held in London, in April 1953. Fifteen authorities were asked to submit contributions, under the general title of "Adaptation in Microorganisms." The Editors have added to these papers, portions of the discussions that followed each presentation. Titles are as follows: Adaptation, Evolutionary and Physiological: or Darwinism among the Micro-organisms: Observations on Bacterial Adaptation; The Nature of Variations Affecting Bacterial Adaptability; A Specific Relation between Enzymic Adaptation and Cytoplasmic Mutation; The Mature of the Precursor in the Induced Synthesis of Enzymes; Specific Inhibition and Induction of Enzyme Biosynthesis; Stages in Enzyme Adaptation; The Effect of Temperature on Enzymic Adaptation, Growth and Drug Resistance; The Development of Drug Resistance in Microorganisms; Antibiotic-resistant Staphylococcal Variants; The Ecology of Tubercle Bacilli Resistant to Streptomycin and Isoniazid; Influence of Bacteriophage on Bacterial Variation and Evolution; Adaptations in *Paramecium;* Environmental and other Aspects of Adaptation in Thermophiles; Ecological Adaptations in Fungi.

The Physics of Viruses. E. C. POLLARD. 230 pages. Academic Press, Inc., 125 East 23rd Street, New York 10, N. Y. (1953) $5.50.

The author writes that this book is "an attempt to present what is known about viruses from the viewpoint of a physicist." It is pointed out that the interest in the physics of living systems, which was so active in the mid-eighteenth century when Mayer, Helmholtz, and Tyndall were leaders in contemporary thought, has passed through a rather low period. The reasons are simple: the biologists have been busy applying chemical ideas and the physicists have been reformulating the laws of nature. Gradually, however, physicists have been turning their attention to biological systems and "important pieces of structural knowledge" appear every month now. Chapter heading indicates the scope of the text: The Nature of Viruses and their Relation to Physics; The Size, Shape and Hydration of Viruses; Ionizing Radiation and Viruses; Thermal Inactivation of Viruses; The Surface of Viruses; Action of Ultraviolet Light on Viruses; Sonic and Osmotic Effects on Viruses; Virus Genetics, Virus Multiplication, and Virus Physics.

Soil and Fertilizer Phosphorus in Crop Nutrition. Edited by W. H. PIERRE and A. G. NORMAN. 492 pages. Academic Press, Inc., 125 East 23rd Street, New York 10, N. Y. (1953) $9.00.

This volume is No. IV in a series of monographs prepared under the auspices of the American Society of Agronomy. Because of the rapid growth in recent years of knowledge in all aspects of the subject of phosphorus in relation to growth of plants, a symposium was held at Urbana, Illinois in August 1952, under the sponsorship of the American Society of Agronomy, the Soil Science Society of America, and the National Soil and Fertilizer Research Committee. This monograph was planned concurrently with the meeting. The authors were the speakers at the Symposium. However, the contents are not limited to the proceedings of the Symposium. Much additional material, which could not be given orally because of time limitations, is included with full citations of the original sources.

Biochemical Preparations. Volume III. Edited by ESMOND E. SNELL. 128 pages. John Wiley & Sons, 440 Fourth Avenue, New York 16, N. Y. (1953) $3.50.

The Editor of Volume III in this series states, "The success of *Biochemical Preparations* depends upon the continued cooperation of biochemists in submitting useful, thoroughly checked procedures for preparing compounds of biochemical interest." Twenty-four compounds are included in this edition.

International Review of Cytology. Volume II. Edited by G. H. BOURNE and J. F. DANIELLI. 545 pages. Academic Press Inc., 125 East 23rd Street, New York 10, N. Y. (1953) $11.00.

The Editors state in their foreword, "We have continued our policy of regarding the field of Cytology and Cell Physiology as a single field and the present reviews are drawn from some of the most active areas in this field. As in Volume I, there are several papers on cytochemistry, on the cell nucleus, on nucleo-cytoplasmic relations, electron microscopy, and on active transport phenomena. There are also papers on growth and differentiation, on the integration of enzyme activities, and on the physiology of gustatory and olfactory epithelia." They add, "Our general policy will continue to be the publication of critical discussions of data published elsewhere, and of new theoretical work. The majority of contributions will continue to be made by invitation but we are prepared to consider reviews and theoretical articles sent voluntarily."

Radioactive Isotopes: An Introduction to their Preparation, Measurement, and Use. W. J. WHITEHOUSE and J. L. PUTMAN. 424 pages, illustrated with graphs and diagrams. Oxford University Press, 114 Fifth Avenue, New York 11, N. Y. (1953) $10.00.

The authors, who are associated with the British research center at Harwell, present material intended primarily for the use of scientific workers, who, while they may be experts in their own field of study, have no specialized knowledge of radioactive theory and technique. A general knowledge of physics is the only qualification which is assumed. Since a certain acquaintance with nuclear properties is essential, a brief account is given of basic nuclear physics. The general laws affecting the various types of radioactive decay are described and the properties of the radiations are stated. A

chapter is devoted to the methods of producing radioactive species, showing the possibilities and limitations of production in piles and cyclotrons. Methods of measuring the radiations and their effects on matter are described at some length, since these are likely to be the chief concern of a large number of users. With only an occasional exception, the information and references contained in this book were published before the end of 1950.

Symposium on Radiobiology: The Basic Aspects of Radiation Effects on Living Systems. Edited by JAMES J. NICKSON. 465 pages. John Wiley & Sons, 440 Fourth Avenue, New York 16, N. Y. (1952).

Biochemistry and Physiology of Nutrition. Volume II. Edited by G. H. BOURNE and G. W. KIDDER. 641 pages. Academic Press Inc., 125 East 23rd Street, New York, N. Y. (1953) $15.00.

With twelve compact chapters contributed by specialists in the field of nutrition, this volume contains discussions of the following subjects: The Intracellular Localization by Histochemical Methods of Enzymes and Vitamins, Structural Changes in Vitamin Deficiency, Microbiology of Digestion, The Nutrition of Invertebrate Animals, Energetics and Metabolic Function, Hydrolytic and Phosphorolytic Enzymes, the Respiratory Enzymes, Coenzymes, Iron Metabolism, Calcium and Phosphorus Metabolism, Trace Elements, Application to Human Nutrition.

Vitamins and Hormones. Advances in Research and Applications. Volume XI. Edited by R. S. HARRIS, G. F. MARRIAN and K. V. THIMANN. Academic Press Inc., 125 East 23rd Street, New York, N. Y. (1953) $8.50.

This is Volume XI in the Academic Press series of Advances in Vitamins and Hormones. Section titles include: Function of Ascorbic Acid in Plants, The Biochemistry and Physiology of Vitamin D, The Physiology and Biochemistry of Ascorbic Acid, Endocrine Disturbances in Chronic Human Malnutrition, Relation of Pantothenic Acid to Adrenal Cortical Function, Recent Knowledge of the Biochemistry of the Thyroid Gland, Evaluation of Procedures for the Cytological Localization of Ketosteroids, Syntheses of Cortisone and Related Steroids.

Advances in Virus Research. Edited by KENNETH M. SMITH and MAX A. LAUFFER. 362 pages. Academic Press Inc., 125 East 23rd Street, New York, N. Y. (1953) $8.00.

This is the latest in an imposing group of review volumes covering an ever-increasing number of research fields published by the Academic Press. As in related volumes, this first one of a projected annual series on virus research, has been prepared by a distinguished group of editors and authors. To virologists, Kenneth M. Smith of Cambridge, England and Max Lauffer of Pittsburgh, Pa. need no introduction. They have done a competent job of editing.

The contributors and their reviews follow: The Properties of Bacteriophages, H. T. Epstein; Interactions between Viruses and Virus Strains, C. W. Bennett; Transmission of Plant Viruses by Cicadellids, L. M. Black; Insect Viruses, G. H. Bergold; Multiplication of Influenza Virus in the Entodermal Cells of the Allantois of the Chick Embryo, W. Henle; Poliomyelitis, J. M. Melnick; Purification and Properties of Animal Viruses, D. G. Sharp; Virus Nucleic Acids, R. Markham.

The volume is well printed and illustrated. Each section has a bibliography and there is an author and subject index.

General Virology. S. E. LURIA. 427 pages, illustrated. John Wiley & Sons, 440 Fourth Avenue, New York, N. Y. (1953) $8.50.

The science of virology, beginning as a branch of the science of bacteriology, has now come of age as evidenced by such texts as this one by Professor S. E. Luria of the University of Illinois. The book represents an attempt to systematize the knowledge about viruses for teaching purposes rather than to meet the needs of the research specialist who, however, will find the text useful.

In nineteen chapters the author takes up: the science of virology; detection and identification of viruses; titration of viruses; size and morphology of virus particles; purification and chemical composition of virus material; seriological properties of viruses; environmental effects on virus particles; virus-host interaction—the bacteriophage-bacterium system; the interaction of plant viruses with their host plants; the interaction of animal viruses with their hosts; tissue cultures—intracellular inclusions; growth of viruses in the chick embryo; hemaglutination phenomena and virus growth; summary on virus reproduction; interference phenomena in virus infections; variation in viruses—host variation and susceptibility to viruses; transmission, vectors and survival of viruses; viruses and tumors; origin and nature of viruses; the rickettsia. The book is well illustrated and there is a bibliography of almost 700 references together with an author and subject index.

LABORATORY MANUALS

Laboratory Exercises for General Botany. HERBERT M. CLARKE and RICHARD I. EVANS. 104 pages. Burgess Publishing Company, Minneapolis 15, Minn. (1953). $1.50. 26 exercises.

General Botany Laboratory Manual. JOHN W. HALL. 218 pages. Burgess Publishing Company, Minneapolis 15, Minn. (1953). $3.50. 44 exercises.

Laboratory Manual for General Botany.
Part I. ROBERT W. HOSHAW, SANFORD S. TEPFER and BARBARA J. PEEBLES. Burgess Publishing Co., Minneapolis 15, Minn. (Rev. 1953). $2.00. 14 exercises covering essentially the morphology and physiology of angiosperms.
Part II. ROBERT W. HOSHAW and SANFORD S. TEPFER. Burgess Publishing Company, Minneapolis 15, Minn. (Rev. 1953). $2.00. 14 exercises on survey of plant kingdom.

Laboratory Manual for General Botany. WARD L. MILLER. 133 pages. Burgess Publishing Company, Minneapolis 15, Minn. (1953). $2.50. 31 exercises.

Synopsis of Medical Entomology. V. E. BROWN. 219 pages, 136 figures. Paper bound. Published by V. E. Brown, Milwaukee, Wisconsin. (1953). $4.50.

Synopsis of Medical Parasitology. V. E. BROWN. 109 pages, 103 line drawings. Paper bound. Published by V. E. Brown, Milwaukee, Wisconsin. (1953).

From the Editor

FOR a long time there has been need for an attractive, readable booklet for young people on careers in biology. Through their advisers and counselors we want high school seniors and college freshmen to consider on biology, as well as other professional occupations, for suitability with respect to the characteristics and aspirations of the individual. It would not be our purpose to lure far into biology larger numbers of young people than could be usefully and happily employed in the various branches of the science and its applications, but rather to make reasonably sure that no individual destined for biology would fail to enter it for lack of timely and authoritative guidance. The preparation of such guidance literature is appropriate for AIBS, because a student should first be made aware of the whole field of biology; later, with the help of more detailed information from the specialized biological

societies, he should choose the branches of biology that he will pursue.

The *AIBS Bulletin* has already recognized the guidance problem and is publishing a series of inspirational guest editorials by eminent biologists. These one-page articles can be torn from the *Bulletin* and sent to young people, or reprints can be bought from the AIBS office and distributed. They provide stimulating insights into the motivations of great biologists, but they cannot and do not picture the whole biological scene. Therefore plans are being made at this writing (November, 1953) for the preparation, publication and distribution of the desired guidance booklet. A writer and publisher have been secured. By the time this issue of the *Bulletin* appears, the presidents and secretaries of all national biological societies will have been requested to furnish information about their subdivisions of biology, from which our writer can draw facts for his use. Some societies have already prepared such material for their own purposes; others have not yet done so. Whatever information the societies can provide within a certain time limit will help to make the booklet authoritative. Information will be sought also from industrial, governmental, educational and other sources.

Although our writer is an experienced biologist, he will need all the help that can be provided by those who are interested in the project. He will not assume that he knows what is best for counselors and students. Adhering to the principle that biology must never be made ridiculous in order to attract attention, he will consult high school teachers and students to determine what *they* want and how they think the material should be presented in order to gain and hold their attention. He will also be glad to get from any reader of the *Bulletin* through us advice and opinions pertinent to his project.

Until the guidance booklet is completed, distributed, and evaluated, we shall have something to say about it in each issue of the *Bulletin*. In the next issue we should be able to give the production schedule and a report of progress in carrying it out.

Changing the subject, we wish to mention other constructive projects that are now being incubated by the Publications Committee of AIBS. This committee, now headed by William R. Duryee, is composed of biologists who are concerned about economical and effective publication or recording of the results of biological research and about efficient utilization of these results in further research. They have set a long-range goal toward which they will move—not only by exchange and clarification of ideas at committee meetings, but by encouragement of action on specific projects proposed to or by the committee. The following examples of their activities indicate their determination to accomplish something definite for biology.

Milton O. Lee and his subcommittee on central office services for biological publications are ready to help societies who may wish to discontinue volunteer services and institutional subsidization in their editorial and business offices, and, instead, meet all these expenses themselves by setting up an economical, cooperative central office for routine business and editorial services. A recent survey conducted by the AIBS office indicated that most biological societies are not yet able to pay for such services.

Self-sacrificing biologists continue to give freely of their time and energy to the production of the journals of their societies. Why does the biological editor voluntarily reduce his own output of research, expose himself to unfair criticism and ingratitude, and work to the point of exhaustion? What are his motivations and compensations? He could be indulging his urge to be orderly, consistent, and precise in the published record of his branch of scientific research, or he might find support for a modest ego in the power of the editor to make final decisions. Whether popular or not among his colleagues, the editor knows that he is important and necessary to them. Possibly the editorship carries an honorarium that is a much-needed addition to his regular income, but his real compensation for editorial labors is probably not monetary. His satisfaction comes from service—to people, to an organization, to an ideal.

To individuals the editor will give advice and help that can improve and sometimes even save reputations; To his society he will give his loyalty and foster its proud traditions and ambitions; To the ideal of contributing to the growing structure of science for the good of the human race he will give his ultimate allegiance. He must feel that the papers in his journal are not just memorials to their authors but are the substance, perhaps still unassimilated, of the science of the future. If he is thoughtful and forward-looking, he will be as much concerned about the permanent recording of data that he does not publish as with those that go into his journal. He will strive to reduce the frequency of publication per author and the length of papers appearing in his journals, and he will encourage the deposition of all important details of an investigation, including tabular material in the American Documentation Institute or similar repository from which specialists can obtain copies when and as needed. He will be vitally concerned about the availability to future workers of the contents of his journal and its supplementary ADI material. He will refuse to publish any manuscript that is submitted without an acceptable abstract for *Biological Abstracts*. He will give careful attention to the subject indexing of his own journal and encourage and support efforts to prepare annual and cumulative indexes of the biological literature. Realizing that further productive growth of biological science may be limited less by shortage of men, money, and materials than by lack of means to explore efficiently the bulging stores of knowledge, he will be interested in improvements in abstracting, indexing and searching for information.

Such are the thoughts that are passing through the minds of the members of the Publications Committee of AIBS. Desiring to do something specific to improve the utilization of biological literature, the committee proposed to get financial support, if possible, for the development of machine methods for searching the biological literature. The initial objectives could be to test and perfect a machine that was designed and developed by Ralph R. Shaw, Librarian of the U. S. Department of Agriculture and a member of the Publications Committee. Known as the Rapid Selector, this machine will scan a reel of abstracts on 35 mm. film at high speed and will photograph those that carry the wanted-code perforations. The first task, therefore, is to devise a code system that will enable an investigator to get from the machine all abstracts that have a bearing on his question, whatever it may be. A coordinate coding system may be indicated. The code would be worked out in the office of *Biological Abstracts*, as applied to a year's index of that journal. Then, by courtesy of Dr. Shaw, the Rapid Selector would be studied experimentally in the USDA Library, using the coded film prepared by *Biological Abstracts*. This investigation would include a determination of the potential demand for a Rapid Selector if and when a reliable machine can be marketed at a reasonable price. An exhibit on this subject is being planned for the next meeting of AIBS at the University of Florida in Gainesville, September 5-9, 1954.

One can look forward to the time when pertinent abstracts or titles can be furnished an investigator on the day of his inquiry, with the service as near as his telephone. Then there will remain only one problem, to cause the investigator to use this service!

1954 AIBS MEETINGS. UNIVERSITY OF FLORIDA, GAINESVILLE. SEPT. 5-9.

The Rockefeller Foundation and the Biological Sciences

GEORGE W. GRAY

The Rockefeller Foundation, New York City.

THE Rockefeller Foundation's first support for a purely biological interest was given in 1920, when the Foundation was in its seventh year. It voted $12,500 to the National Research Council in Washington to aid the Consilium Bibliographicum of Zurich, Switzerland. The latter organization was operating an international service of card-indexing and abstracting publications in the biological sciences, and because of disruptions following World War I it had fallen into debt and other difficulties. Leading biologists warmly endorsed the Consilium's appeal for help, arguing that its abstracting service was of great value to scientists all over the world; and on this endorsement the Foundation contributed $106,000 toward its support between 1920 and 1926.

At the beginning of this project, the idea was suggested that the National Research Council might accept responsibility for the operation of the Consilium, and in 1921 the Foundation provided a travel grant to enable Vernon Kellogg to explore this idea abroad. The proposed transfer did not materialize, but as an outcome of the inquiry, and of others which followed it, the Union of American Biological Societies decided to establish the now well-known *Biological Abstracts*. This international publication was launched in 1925 with $350,000 from the Foundation, and subsequent grants (the last one in 1948) have brought the total of assistance to $855,000.

These initial actions on behalf of biology were taken at a time when the Foundation had no formal program in the natural sciences. Its only systematic activity in this field was support of the annual fellowships of the National Research Council, which had been started in 1919 for the training of physicists and chemists. The Foundation's predominant interest in the first decade and a half of its operations (1913-1928) was the advancement of medicine and public health, and more than ninety per cent of its annual appropriations were going into these twin fields. The remainder was contributed to what we may call miscellaneous causes, and among these, to be sure, were projects in biology. For example, in 1923 the scope of the National Research Fellowship program was widened to include biologists as well as physical scientists, and the appropriation for fellowships was proportionately increased. During this period, too, the first grants were made for the Marine Biological Laboratory at Woods Hole, the Hopkins Marine Station of Stanford University, and the Institute of Biological Research at Johns Hopkins.

But these early grants were not steps in an over-all program to promote biology as such. They totaled barely $2,000,000, and for the most part were justified on the ground that biology was a premedical science and assistance to it would contribute to the program in medicine and public health. It was not until 1929, when the Foundation instituted a division of natural sciences, that it took up the advancement of biology as a well-defined objective.

The Natural Sciences Division

There were several reasons for setting up a division of natural sciences. For one thing, the International Education Board, which had been established in 1923 with funds given by John D. Rockefeller, Jr., had developed a considerable program in the natural sciences, including grants to research institutions and fellowships for promising young scientists. This program had been directed mainly at strengthening European universities and personnel, and in 1928, having disbursed its funds, the Board terminated its program. At the same time, parallel with this work on an international scale, the General Education Board, another Rockefeller fund, had been making grants to institutions in the United States for the erection of laboratories, the purchase of equipment, and the support of research and teaching in the natural sciences.

In 1928, the Trustees made a searching review of the Foundation's activities and decided to expand the program beyond (1) medicine and (2) public health, by setting up (3) a natural sciences division to take over and continue the operations begun by the International Education Board and the General Education Board, and in addition to establish (4) a division of social sciences and (5) a division of the humanities. The following year therefore witnessed a general reorganization of the staff and a broadening of the program under five divisions.

The Natural Sciences Division has had three directors. Max Mason, mathematical physicist and former president of the University of Chicago, was the first. But before the end of 1929 he had been elected president of the Foundation, and Herman A. Spoehr, of the Carnegie Institution's Laboratory of Plant Research, was appointed to succeed him as director. Toward the end of 1931 Dr. Spoehr resigned to return to his research, and early in 1932 Warren Weaver was elected. He came from a professorship at the University of Wisconsin, where he was head of the department of mathematics, and immediately began a survey of opportunities in relation to resources. "A highly selective procedure is necessary if the available funds are not to lose significance through scattering," Dr. Weaver noted in a memorandum. "In the past, this selection has consisted chiefly of a choice of scientific leaders, among both men and institutions, although there has always been some selection on the basis of fields of interest. It is proposed, for the future program, that interest in the fields play a dominant role. Within the fields of interest, selection will continue to be made of leading men and institutions."

What came out of this analysis was a proposal to "increase the emphasis on biology." Acting on this recommendation, the Trustees, in the spring of 1933, voted to make *experimental biology* the Foundation's field of primary interest in the natural sciences. Today, therefore, at the end of 1953, it is possible to look back on two decades during which the advancement of biology has occupied first place in the thinking and planning of the Natural Sciences Division.

The Program in Experimental Biology

"Condensed to one sentence," explained Dr. Weaver, "the program is concerned with the constitution, structure, and functioning of living organisms and their component parts, including a special interest in applying the analytical and experimental techniques of chemistry, physics, and mathematics to basic biological problems."

More specifically, the program may be outlined under four headings:

Biology—cytology, ecology, embryology, genetics, histology, microbiology, molecular biology, and physiology.

Chemistry and Biology—biochemistry, organic chemistry, and physical chemistry applied to biological problems.

Physics and Biology—biophysics, radiation biology, structure analysis, and biophysical instrumentation.

Mathematics and Biology—mathematical biophysics, statistics.

To name all the institutions and persons whose research in these specialties has been assisted by Rockefeller grants and fellowships would reduce this article to a formidable list, but it may be practicable in the space available to give an idea of the scope of the program by citing a few examples under each heading.

Biology

Many of the appropriations have been of an institutional nature, to provide a building, equip a laboratory, or support a general program which serves many specialties. For example, the Marine Biological Laboratory at Woods Hole, which received its first grant back in 1924, has had several additional ones under the new program, and Foundation assistance to date totals $941,400. Appropriations for buildings, equipment, and support of the Yerkes Laboratories for Anthropoid Research have been $1,032,000 through the Natural Sciences Division, in addition to $200,000 through the Division of Medicine and Public Health. Similarly, the Roscoe B. Jackson Memorial Laboratory has received $256,000 through the Natural Sciences Division and $534,000 through Medicine and Public Health. The NRC Committee for Research in Problems of Sex, which has sponsored numerous studies in endocrinology, embryology, and other specialties of experimental biology, has also received support from both divisions—$401,043 through the Natural Sciences and $1,151,351 through Medicine and Public Health.

The biological specialty which has received probably the largest proportion of support is genetics. Soon after Thomas Hunt Morgan went to the California Institute of Technology, a grant was made to assist his research, and almost continuously since that time genetics at Caltech has been supported—in addition to other biological studies there. H. J. Muller's distinguished work has been assisted through a series of grants—first at the University of Edinburgh, then at Amherst College, and more recently at Indiana University. An appropriation now current at Indiana is divided among Muller, Ralph E. Cleland, and T. M. Sonneborn. Among other geneticists whose programs have attracted Foundation support are L. C. Dunn and Th. Dobzhansky at Columbia University, Albert L. Blakeslee at Smith College, Curtis and Stadler at the University of Missouri, J. T. Patterson and his associates at the University of Texas, Joshua Lederberg at the University of Wisconsin, and E. L. Tatum and George W. Beadle on the Pacific Coast. A recent check through the records shows that assistance has been given to genetics in fifty-three institutions, and the Foundation itself has directly engaged in experimental genetics on a large scale through its agricultural research program in Mexico.

There have been numerous grants for specific research projects in cell structure, cell physiology, tissue structure, embryology, and microbiology—and the list of investigators who have been aided is broadly representative of both North American and European research. Work in each of these specialties is now so much a matter of the application of physical or chemical tools and techniques that it is sometimes a question whether a study is to be classified as a project in cytology, for example, or one in biochemistry or biophysics. These two borderlands of biology have been intensively cultivated by Weaver and his associates. Over the last twenty years, there has been a sustained effort to encourage the development and refinement of the tools and techniques so that they will be more powerful as aids to biological investigation.

Biochemistry, Biophysics, and Biomathematics

Prominent among the tools are the ultracentrifuge and the electrophoresis apparatus. Thé Svedberg, the inventor of the ultracentrifuge, was aided in his early experiments by the International Education Board, and as soon as the Foundation launched its program in experimental biology it began a series of grants to Upsala University to assist Professor Svedberg, both in the further development and refinement of his apparatus and in the protein studies which he conducted with its aid. Grants were also made to Jesse W. Beams of the University of Virginia to finance his development of an electrically driven ultracentrifuge. Finally, the Foundation itself, through a sustained developmental program over a period of several years in its International Health Laboratory in New York, made important contributions to the instrumentation of ultracentrifugation.

The electrophoresis apparatus, in the form most widely used, was invented by Arne Tiselius, a former Rockefeller fellow, and several grants have been made to Upsala to provide equipment, supplies, and other support for his research.

The application of isotopes to biological investigation has also been assisted at a number of research centers. George Hevesy, the originator of the tracer method, has been aided both at Stockholm and at Copenhagen, and a current grant to the University of Copenhagen is financing an intensive study of the biological uses of isotopes being jointly conducted there by Niels Bohr, P. H. Rehberg, and George Hevesy. Before his death August Krogh was a member of this Rockefeller-assisted team.

But electrophoresis, ultracentrifugation, and tagged atoms are not the whole armamentarium of the biochemist. He needs also spectroscopes, photometers, colorimeters, chromotographic apparatus, x-ray equipment, electron microscopes, and a wide range of other instruments—and an important part of the program in experimental biology has been to assist key investigators to obtain the tools necessary to their work. In postwar Europe, particularly, these equipment grants have saved the day for many investigators in countries where dollar credits were scarce.

Numerous grants have been made to support research programs in biochemistry, particularly in the fields of enzymes, vitamins, hormones, plasma proteins, nucleic acids, and other units of molecular biology. Among the enzymologists who have been aided are J. B. Sumner of Cornell, David E. Green and his associates at the Enzyme Institute of the University of Wisconsin, Carl F. Cori of Washington University (St. Louis), Hans Neurath of the University of Washington, Fritz Lipmann of the Massachusetts General Hospital, H. A. Krebs of Sheffield University, Linderstrom-Lang of the Carlsberg Foundation, Copenhagen, and M. von Euler of Stockholm.

Grants to support research on proteins have been made to Harvard for E. J. Cohn's physico-chemical studies, to Oxford for Sir Robert Robinson's essays in protein synthesis, to Leeds for W. Astbury's x-ray attack on big molecules, to Yale for Joseph Fruton's studies of peptides, to California Institute for Linus Pauling's research, to Wisconsin for J. W. Williams's ultracentrifuge analyses of plasma proteins, to Brooklyn Polytechnic Institute for David Harker's structure studies, and to the University of Illinois for W. C. Rose's long-sustained and brilliant investigation of amino acids.

In the exciting area of nucleic acid and nucleoprotein research, there is also a distinguished company of workers with whom the Foundation has cooperated by furnishing funds to assist their studies. It includes Einar Hammarsten and Torbjorn Caspersson of the Karolinska Institute, Jean Brachet of Brussels, V. D. Desreux of Liége, M. Stacey of Birmingham, J. N. Davidson of Glasgow, Alexander R. Todd of Cambridge,

Andr[illegible] Boivin of Strasbourg; and, in the United States, Erwin Chargaff of Columbia University, H. S. Loring of Stanford, and Gerhardt Schmidt of Tufts College.

In the field of biophysics, the Foundation has financed studies of the effects of radiation on living matter, spectroscopic studies of biological processes, and research on the fine structure of muscle fibers and other tissue as revealed by the electron microscope—to mention but three among the many lines of investigation that have been supported. In biomathematics, there have been projects in mathematical biophysics at the University of Chicago, in biometry at the University of London, and in mathematical analysis of genetic populations at the Institute of Statistics of the University of North Carolina.

All the fields of experimental biology have been enriched and strengthened through the fellowship programs—the National Research Fellowships administered by the National Research Council and the Rockefeller Fellowships administered by the Foundation itself. This Foundation program is a continuation of the fellowship program instituted in the 1920's by the International Education Board. As directed by the Natural Sciences Division, the Rockefeller Fellowships have been used to supplement the National Research Fellowships in the United States and to assist young scientists of other countries where the NRC program does not operate. Up to the end of 1952, the list of those who had received Rockefeller Fellowships in the natural sciences totaled 1,334, and of these, 507 were in biology, biophysics, and related fields. Figures for the National Research Fellowships show that of 1,084 fellows appointed since the beginning of the program, 460 were workers in biology. Thus, approximately 1,000 biologists have received training through the two programs.

The Extent of the Support

The total appropriated through the Natural Sciences Division up to the beginning of 1953 is $47,438,443. The geographical distribution of these funds has been as follows:

United States	$30,366,757
Europe	$ 9,423,954
Latin America	$ 5,885,035*
Elsewhere	$ 1,762,697

*The figures stated in the above table are not strictly comparable, since expenditures in Latin America by the Natural Sciences Division did not begin until 1941.

Approximately eighty per cent of the appropriations for the United States, Europe, and elsewhere were for projects in experimental biology; in Latin America, where the opportunities in the natural sciences are more limited, the bulk of the funds has gone for projects in agriculture and veterinary medicine, with just over eight per cent for experimental biology. On this basis, the total given for the assistance of biology approximates $34,000,000.

"It is worth noting," pointed out Dr. Weaver, "that at the beginning of our program there was very little outside money available to universities and other institutions to supplement their own resources for the support of research in experimental biology. The Rockefeller Foundation was almost alone in the field, and was by far the major source of such support. Today, with the United States Public Health Service, the National Science Foundation, the Office of Naval Research, and other public and private agencies pouring millions into grants for biological research, our annual contribution, although it is little diminished from what it was ten or twenty years ago, is a very small percentage of the whole. In fact, I figure that since the war, it has averaged barely six per cent of the outside money available for the support of experimental biology, whereas in the early 1930's, the support for biology from The Rockefeller Foundation doubtless constituted the major part of the outside funds that were available to universities."

In view of this changed situation in resources available for the support of biological research, and in view also of the critical world situation with regard to food production, the Trustees of The Rockefeller Foundation decided in 1951 to shift the emphasis of the natural sciences program to agriculture. As announced by the President of the Foundation: "According to this decision, experimental biology will continue to be an active interest of the natural sciences program, but on a reduced scale in the United States, and the greater part of the effort will hereafter be devoted to the promotion of scientific agriculture." As a consequence of this change in the program, the Natural Sciences Division is now known officially as the Division of Natural Sciences and Agriculture.

The American Type Culture Collection

A Museum and Distribution Center of Microbial Cultures

FREEMAN A. WEISS, *Curator*

SOME arrangement whereby cultures of microörganisms can be preserved, in viable usually monotypic state, is about as important as the original isolation and description of the organisms themselves. The preservation of living cultures is all but indispensable, especially in the case of microörganisms, of which a mere description and illustration, even though supplemented with well-preserved but nonvital preparations, leaves much to be desired in a taxonomic sense to establish its characteristics as a distinct type (especially applicable to bacterial cultures). As for physiological races that have some distinctive and important functional capacity, the need for conserving living specimens is even greater, though it is to serve economic rather than taxonomic ends.

Hence, at least a temporary accumulation of cultures, and sooner or later the preservation of selected types, becomes a concern of all biologists who work with culturable material. Surprisingly, however, the function of preserving cultures of microörganisms has always been carried on somewhat haphazardly, often remaining only the personal concern of individual workers, or sometimes attaining the state of an accessory activity of some institution's department of microbiology. The trend toward more comprehensive, better kept, and permanent collections of cultures in institutional and commercial laboratories has greatly increased in recent years, with the growth of industrial mycology, and as biological methods have more and more displaced purely chemical operations in the medical

and pharmaceutical fields. Still, they have not attained recognition as an appropriate function of government.

Pertinent to this it should be recalled that the Smithsonian Institution, which is the Federal Government's assemblage of museums of various kinds (as well as serving other functions), began to gather, study and display collections of *macrobiological* objects even before 1870, when its museum activities were first specifically authorized by Congress. It now has collections representative of most human interests from fossils to airplanes and from engineering to art, but nothing as minute as bacteria and viruses. Of course there are economic reasons for neglecting, as museum objects, the microscopic biological world. To preserve microörganisms in the living state requires equipment and effort in inverse proportion to their size. Furthermore, they are difficult to display effectively even to educated laymen, almost impossible to the casual museum visitor. Microbes are, however, steadily growing in importance and appreciation, not only in the realm of science but as factors in everyday human life. Sometime this importance, and the growing interest of the public in the activities of microörganisms, will require that museums devote attention to their collection and display just as they now do for more tangible objects. In the meantime culture collections lacking this official status must meet the need, if not of offering public instruction, at least of preserving and providing the cultures that microbiological science requires.

As a means of coördinating and perpetuating several collections of bacterial and mold cultures, including a number of historic strains, and of providing a center for the convenient acquisition of cultures needed in research, the American Type Culture Collection was organized, as a non-profit corporation, in 1925. Its founders were L. A. Rogers and H. J. Nichols representing the Society of American Bacteriologists; Frederick P. Gay, the American Association of Pathologists and Bacteriologists; C. L. Shear, the American Phytopathological Society; C. A. Kofoid, the American Society of Zoologists. A committee of the National Research Council, including in its membership Ludvig Hektoen, R. A. Harper, and M. M. Metcalf, was godfather to the foundling and the angel that guaranteed its successful start in life was the Rockefeller Foundation with an initial endowment of $24,000 and subsequent contributions totaling $10,000.

The ATCC began operations at the John McCormick Institute for Infectious Diseases in Chicago, in February, 1925, under the direction of George H. Weaver as curator, and with 175 cultures, the residue of a collection of 500 bacterial cultures that C. E. A. Winslow had assembled at the American Museum of Natural History. In its first year the number of cultures in the collection grew to 525, representing 245 species. A total of 1540 cultures were distributed to clients by sale at one dollar each or by exchange. It is noteworthy that only a half dozen mold cultures figured in this total, the rest being bacteria.

The young organization had its growing pains and "youthful diseases," the most serious of which occurred during the business recession in 1932 and '33, and nearly wiped it out financially. In no year, however, did the organization fail to operate within income, and both the number of strains in the collection and the number of cultures furnished to clients grew steadily. The latter statistic reached 5,000 in the fifth year. A number of friends helped the ATCC in its early years. Aside from the initial gifts from the Rockefeller Foundation, it received an annual contribution of $400 from the Society of American Bacteriologists for nine years, and other subsidies totaling about $6,000. Periodic donations from firms in the drug and allied industries added up to $10,000. After the sixth year, however, the ATCC was essentially self-supporting, deriving 80 to 90 per cent of its income from the sale of cultures. As the price of cultures was then only one or two dollars each, and many were exchanged gratuitously, this was a remarkable showing of thrifty and efficient management.

The Collection twice suffered geographic dislocation, first in 1937 when it was transferred from the McCormick Institute to the Medical School of Georgetown University in Washington, and again in 1947 when it occupied its present independent quarters. The expense incident to this move caused another crisis in its finances, from which it was rescued by the activity of a committee of the National Research Council, which obtained contributions from the drug and biologicals industries enough to offset these costs and provide a reserve against future difficulties. This reserve fund has remained practically untouched, however, since 1949, and the ATCC now operates fully on its own, save for an annual subsidy varying from $1,500 to $3,000 from UNESCO.

Five editions of a catalog of cultures have been issued, the last in 1949, which listed 2975 strains, including 1458 bacteria, 833 filamentous fungi, 476 yeasts, and a few algae, protozoa, and bacteriophages. A supplement to the 1949 catalog, issued in 1952, listed 506 new strains, and another soon to be released contains 409. This does not represent a net increase of the same numbers in the size of the collection, as old and deteriorated strains are periodically discarded and replaced.

In 1950, through the coöperation of a group of virus specialists of the Society of Bacteriologists, a collection of viral and Rickettsial agents of human and animal diseases was established, which at present contains 63 strains. The American Phytopathological Society was instrumental also in creating a registry of plant viruses, currently containing 103 types, which are maintained by collaborators but for which the ATCC is the distribution center. In the publication of the catalogs of cultures and the lists of animal and plant viruses, the financial aid of UNESCO, the Society of American Bacteriologists, the National Research Council, and the American Phytopathological Society is gratefully acknowledged.

From its inception in 1925 through 1952 the ATCC has distributed over 150,000 cultures to research and educational institutions, hospitals, government laboratories, and individuals.

Currently the Collection operates with a technical staff of five, including a curator, two bacteriologists, a mycologist, and a technician. The business side of its operations is conducted by a secretary-manager and part-time office assistants. This staff maintains about 3,500 different cultures, annually distributes to clients about 8,000, prepares and inoculates over 50,000 culture tubes, and lyophilizes (freeze-dries) seven to eight thousand for long-term preservation.

The supply service is commendably prompt. As a rule transplants to fill orders are made the same day the order is received, and with quick-growing organisms the cultures are ready to mail within three days. Cultures are regularly sent to all parts of North and South America, frequently to Europe, and occasionally to Asia, Africa, and Australia, the speed of air mail delivery making such distant distribution feasible.

Though not the largest centralized culture collection in the world the ATCC, according to reports made to the International Federation of Culture Collections, distributes more cultures to clients than any other. In collaboration with other culture collections, such as the National Collection of Type Cultures of England, and through the offices of the International Microbiological Congress, the ATCC is attempting to obtain uniform designation and preservation of certain historic cultures as type cultures to serve as permanent reference standards.

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Nobel Prize Winners

Dr. Fritz A. Lipmann, Harvard University, was awarded the 1953 Nobel Prize in Medicine and Physiology jointly with Dr. Krebs. Dr. Lipmann, now professor of biological chemistry at Harvard, isolated and identified coenzyme A, a substance which plays an important part in transferring energy and in the synthesis of many cell chemicals.

Dr. Hans A. Krebs, professor of biochemistry at Sheffield University in England, discovered the citric acid cycle, now called the Krebs cycle, which is one of the most important of the burning processes by which cells convert food into energy. Both Drs. Krebs and Lipmann are German-born scientists and refugees from the Nazi regime.

Dr. Frits Zernike, professor of mathematics and physics at Groningen University in the Netherlands, won the Nobel Prize in Physics for his invention of the phase-contrast microscope. This instrument has become a tool of biologists everywhere, enabling them to observe structures of living cells.

Nobel Prize Winners in Physiology and Medicine—1901-1953

For over half a century the highly-coveted Nobel prizes have been awarded annually in five fields: chemistry, physics, physiology and medicine, literature, and peace. Alfred Nobel, Swedish inventor who gave the world dynamite and emassed a fortune from his inventions, converted his estate into the trust fund from which these prizes are awarded. Although the monetary value of the awards is high, the prestige in the world of science and the arts is even greater.

YEAR	NAME	COUNTRY	WORK
1901	E. A. von Behring	Germany	Diphtheria Serum
1902	R. Ross	Great Britain	Malaria Mosquito to Human
1903	N. R. Finsen	Denmark	Light Treatment for Skin Diseases
1904	I. P. Pavlov	Russia	Physiology. Digestion
1905	R. Koch	Germany	Scientific Bacteriology and Cultures
1906	C. Golgi	Italy	Structure of Nervous System
	S. Ramon y Cajal	Spain	
1907	C. L. A. Laveran	France	Protozoan disease. Trypanosomes
1908	P. Ehrlich	Germany	Immunity
	E. Metchnikoff	Russia	
1909	T. Kocher	Switzerland	Thyroid Physiology. Path. Surg.
1910	A. Kossel	Germany	Cellular Chemistry. Albumin
1911	A. Gullstrand	Sweden	Dioptrics of Eyes
1912	A. Carrel	United States	Vascular Seams. Blood Vessel Transplantation
1913	C. Richet	France	Anaphylactic Test
1914	R. Barány	Austria	Phys. & Path. of Vestib. Hyp.
1915	No award.		
1916	No award.		
1917	No award.		
1918	No award.		
1919	J. Bordet	Belgium	Immunity
1920	A. Krogh	Denmark	Capillary Regulation
1921	No award.		
1922	A. V. Hill	Great Britain	Heat-Muscles
	O. Meyerhoff	Germany	O_2 Consumption
1923	F. G. Banting	Canada	Insulin
	J. J. R. Macleod	Canada	
1924	W. Einthoven	Netherlands	Electrocardiograph
1925	No award.		
1926	J. Fibiger	Denmark	Spiroptera Carcinoma
1927	J. Wagner-Jauregg	Austria	Malaria Vaccination in Dem. Paralytica
1928	C. J. H. Nicolle	France	Typhus Exanthematicus
1929	F. G. Hopkins	Great Britain	Growth Promotion Vitamins
1930	K. Landsteiner	Austria	Human Blood Groups
1931	O. Warburg	Germany	Respiratory Ferment
1932	C. Sherrington	Great Britain	Neurone Function
	E. D. Adrian	Great Britain	
1933	T. H. Morgan	United States	Hereditary Function of Chromosomes
1934	G. H. Whipple	United States	Liver Therapy in Anemia
	G. R. Minot	United States	
	W. P. Murphy	United States	
1935	H. Spemann	Germany	Organizer Effect Embryonic Development
1936	H. H. Dale	Great Britain	Chemical Transmission of Nerve Impulses
	O. Loewi	Austria	
1937	A. Szent-Györgyi	Hungary	Vit. C. Biol. Combustion Cat. Fumaric Acid
1938	C. Heymans	Belgium	Sinus & Aorta Mechanism in Respir. Regulation
1939	G. Domagk	Germany (declined)	Prontosil
1940	No award.		
1941	No award.		
1942	No award.		
1943	H. Dam	Denmark	Vitamin K
	E. O. Doisy	United States	
1944	E. J. Erlanger	United States	Neural Research
	H. S. Gasser	United States	

YEAR	NAME	COUNTRY	WORK
1945	A. Fleming	Great Britain	Penicillin
	H. W. Florey	Great Britain	
	E. B. Chain	Great Britain	
1946	H. J. Muller	United States	Hereditary X-Ray Effects
1947	C. F. Cory	United States	Enzyme-Animal
	Gerty F. Cory	United States	Starch to Sugar
	B. A. Houssay	Argentina	Pit. Hormone Function
1948	P. H. Mueller	Switzerland	D.D.T.
1949	W. R. Hess	Switzerland	Mid. Brain Function Prefrontal Leucotomy
	E. A. Moniz	Portugal	
1950	P. S. Hench	United States	Cortisone and other Adrenal Hormones
	E. C. Kendall	United States	
	T. Reichstein	Switzerland	
1951	Max Theiler	United States	Yellow Fever Vaccine
1952	Selman A. Waksman	United States	Streptomycin
1953	Hans A. Krebs	Great Britain	Krebs cycle. Biochemistry
	Fritz A. Lipmann	United States	Coenzyme A. Biochemistry

Biological Research in the Pacific Area

HAROLD J. COOLIDGE

Executive Secretary, Pacific Science Board, Washington, D. C.

THE advancement of science in the Pacific Basin is the concern of two organizations, the Pacific Science Board and the Pacific Science Association. Some confusion has arisen over the distinctions that exist between these two groups. Essentially the difference is simple: the Pacific Science Board is American and the Pacific Science Association is international. Both are dedicated to the furtherance of scientific investigation and cooperation in the Pacific area and they work closely together without duplication of effort.

The Pacific Science Board, a Committee of the National Academy of Sciences-National Research Council, was established in 1946 "to aid the scientists of America who wish to engage in scientific investigations for which there is a need in the Pacific area, to advise governmental and other agencies on scientific matters pertaining to the Pacific, and to further international cooperation in the field of Pacific Science." This Board, now in its seventh year, is composed of eleven U. S. scientists, together with six standing committees and a number of consultants. More than 350 scientists have been materially aided through the Board's activities, which stem from the main office in Washington and a branch office at the Bishop Museum in Honolulu. The financial assistance necessary to carry out an extensive field program has been supported through contracts with the Office of Naval Research, Department of the Army, National Science Foundation, as well as by grants from private foundations and individual contributors.

The Pacific Science Association, an international organization, was established in 1920 "to initiate and promote cooperation in the study of scientific problems relating to the Pacific region, more particularly those affecting the prosperity and well-being of Pacific peoples, to strengthen the bonds of peace among Pacific peoples by promoting a feeling of brotherhood among the scientists of all the Pacific countries." Each of the Pacific countries belonging to the Association is represented by one of its leading scientific organizations and thirteen of these Pacific countries have representation on the Pacific Science Council, the executive body of the Association which meets only at the time of the Congresses. The Association's activities for over thirty years have been principally devoted to the holding of eight Pacific Science Congresses, the last of which was held in the Philippines in November 1953. The published proceedings of these Congresses constitute an important documentation of the progress of Pacific research in the physical and natural sciences. Since the Seventh Congress, the Council has maintained a Secretariat located at the Bishop Museum in Honolulu. The duties of the Secretariat are: "to assist Governments, institutions and individuals as well as standing committees of the Pacific Science Association in the implementation of Resolutions and recommendations adopted by Pacific Science Congresses; to serve as a central office for the Pacific Science Council especially during the intervening period between congresses; to serve as an information dissemination center in Pacific science matters; to assist in maintaining a continuity in the relationship between the Pacific Science Association and such international agencies as the specialized agencies of United Nations, and South Pacific Commission."

The activities of the Pacific Science Board of the National Academy of Sciences-National Research Council should be of particular interest to biologists. The first field program started in 1947 and was called Coordinated Investigation of Micronesian Anthropology (CIMA). Forty-two participants from twenty-one universities and museums spent a period of from four to six months doing field work on projects of their own choosing in selected islands of the Marshalls, Carolines and Marianas of the Trust Territory. At that time the Trust Territory was being administered by the Department of the Navy, and not only did the specialists gather information to fill a gap in our scientific knowledge of the area which had been occupied by the Japanese for thirty years, but they also gathered basic information to assist the Navy administrative authorities in setting up adequate and practical civilian government. Assistance with solutions to various problems involved in the rehabilitation, health and welfare of the native inhabitants also resulted from the program.

The Board's Scientific Investigations of Micronesia (SIM) program was a broadening of the original project to other fields of science, including botany, forestry, geography, geology

and zoology. In 1950, a five-year program of research in the ecology of coral atolls was started by sending a team of twelve specialists to study the interrelationships between the environment and the plant and animal life, including man, at Arno in the southern Marshalls. This is a relatively large wet atoll little disturbed by the war. In 1951 a similar study was made by a team of six on the much dryer atoll of Onotoa in the Southern Gilberts: in 1952 a team of seven carried out research on Raroia, one of the less disturbed atolls in the Tuamotu Archipelago; while in 1953 the field team worked at Ifaluk which is a small, relatively undisturbed atoll in the western Carolines.

A systematic survey of the insects of the principal islands of the Trust Territory has been made by entomologists working under a Navy-supported Board program directed by the Invertebrate Consultants Committee for the Pacific (ICCP). The resulting collections are deposited in museums in Honolulu, San Francisco, Chicago, Cambridge and Washington, and are being prepared for identification and detailed study by more than 100 specialists for a publication by the Bishop Museum on the Insects of Micronesia. The ICCP program has also been concerned with the major pest problems of the region such as the coconut beetle *(Brontispa mariana)*, rhinoceros beetle *(Oryctes rhinoceros)*, and the giant African snail *(Achatina fulica)*. Parasitic wasps have been flown in from Java and Zanzibar in an effort to control the coconut and rhinoceros beetle. Carnivorous snails and *Tefflus* beetles have been brought from Africa for laboratory study and experimental use in Honolulu efforts to combat the giant African snail. Agiguan, a small island off Tinian, has been set aside to determine the possibility of using *Gonaxis* as a control for *Achatina*. It is estimated that the original 300 *Gonaxis* increased to 25,000 in about two years' time, but it is still too early to evaluate results of the experiment. The Committee has also assisted two projects carried out at the Institut Oceanographique de Nhatrang (Vietnam); one involving a study on polarized light and the physiology of the compound eye of Asiatic horseshoe crabs, and the other a survey of the marine algae off the coast of Indo-China.

The Scientific Investigations in the Ryukyu Islands (SIRI) program of the Board has concentrated on assisting the Army's administrative authorities of the Ryukyus in problems of rehabilitation and welfare relating to the health and economy of the islands. In addition to extensive work in cultural anthropology, specialists in the fields of tuberculosis, eye diseases, parasitology, and medical entomology have worked on specialized problems relating to the health of the people and their animals. A botanical survey has led to the preparation of a flora of Okinawa, and entomologists have assisted with problems relating to insect pests, quarantine and other factors of importance to the economy of the islands.

In the field of conservation in the Pacific, several conferences dealing with conservation problems have been held in recent years. A conservation officer served in the Trust Territory for fourteen months, and the Territory now employs a hydrologist from the U. S. Geological Survey. A mission under the Board's sponsorship studied the effects of phosphate mining on the land and fresh water supply with relation to the future welfare of inhabitants of Anguar in the Palaus. Certain recommendations resulting from this study are being carried out by agreements between the Government of Japan and the High Commissioner of the Trust Territory.

The subject of the relationship of natural resources to population was discussed at the second South Pacific Conference in 1953 in Noumea. There is also a growing awareness of the need to protect threatened and vanishing species like the Hawaiian Goose (Nene) and the Laysan duck from total extinction.

During 1950 and 1951 extensive botanical collections were made in New Caledonia by a Swiss Expedition aided by grants from five herbaria in this country. This collection, which is the largest ever made there, is now being identified in Zurich and contains a number of important new discoveries. Plans are in progress to have one of the Swiss botanists bring to this country the duplicate material for U. S. collections in 1954. Dr. Guillaumin, the French botanist who has described so many New Caledonia species, participated in the field work.

An ecological study and filming in color of wild cattle, with special reference to the little known Kouprey *(Noribos saureli)*, has recently been completed in Northern Cambodia. It is probable that about five hundred still survive, and the Cambodian Government has been urged to take special measures to protect this primitive bovid by establishing a permanent reserve in the area of their natural habitat. This was a project of the Coolidge Foundation which is concerned with scientific research in Southeast Asia.

Besides various samples of biological investigations of direct concern to the Board mentioned here, there are many independent investigations in the biological field where the Board has been able to be of assistance. These have included the collection of marine mollusks in the Palaus, botanical collecting in Tonga, study of poisonous fishes, etc.

Other Pacific Science Board activities related to the advancement of the biological sciences in the Pacific, have been the participation of a considerable number of U. S. biologists in the Seventh Pacific Science Congress in New Zealand in 1949 and in the Eighth Congress in the Philippines in 1953; research projects of the South Pacific Commission Research Council with which the Board is actively cooperating; and the presentation of scientific collections from many of the Pacific Science Board projects to the U. S. National Museum and the Bishop Museum.

NATIONAL REGISTER OF SCIENTIFIC & TECHNICAL PERSONNEL

Over 9,000 questionnaires, the first group to be mailed, were sent to the members of the Society of American Foresters in November 1953. Mailing to the plant science societies will begin early in January and will continue thereafter to all other biological societies.

Your cooperation is requested in returning your questionnaire promptly and in completely answering all questions.

Training the Conservation Worker

DURING the 1953 meetings of the AIBS at the University of Wisconsin, the National Association of Biology Teachers arranged a symposium on the subject of training conservation workers. Dr. Fred Scheeckle, Wisconsin State College, served as chairman of the symposium. Dr. Harvey Stork, Carleton College, past president of NABT, and Dr. Richard L. Weaver, University of Michigan and Project Leader for the three-year Conservation Project of NABT, arranged the symposium. The five papers presented, representing the fields of forestry, wildlife, fisheries, recreation and education, are printed here in somewhat summarized form. These papers have had to be shortened considerably by the Editor in order to use them in the one issue of the *Bulletin*. We trust the important points in each paper have been retained.

Resource Management Emphasis in Training Technical Foresters

O. F. HALL

University of Minnesota

SPECIALIZED training in forestry at the college level has been going on in this country for the past 50 to 60 years, and in European countries for the past 175 years. The schools teaching professional forestry are continually examining what and how they teach, in order to make modern methods and concepts available to their students. For the most part these schools have successfully avoided being straitjacketed by tradition.

A current modification taking place in forestry training is an example of the deviation from tradition. This modification came about partly through the recognition that many recent developments by ecologists and conservationists would be beneficial in preparing the professional forester for his life work. Foresters have long realized that they are not managing only trees and forests but a complex of all resources. Watersheds, grazing lands, mineral deposits, wildlife populations, recreational areas and scientific natural reserves are all present in the areas that foresters have placed under their direction. Each of these is a separate and distinct resource, and each is demanded by different groups and individuals. Frequently these demands conflict. The administrator of the area possessing several resources must arbitrate between the conflicting demands, and as population pressures increase these conflicts become sharper. For example, harvesting mature timber modifies the wildlife habitat. Uncontrolled wildlife in turn may limit the possibilities of regenerating tree growth. Recreational users demand a wide variety of incompatable types of area, from undisturbed wilderness to mowed picnic grounds and improved cabin sites. And among all these vocal demands is the relatively silent forest ecologist and the biologist trying to protect a few areas in which natural succession may be observed and some silvicultural experiments carried out. All of these are the problems of "multiple use," a term long used by foresters to indicate their belief that maximum benefit can be derived from a wild area only if many uses are coordinated rather than one use given exclusive rights. Usually the satisfaction of more than one user means that the benefits to all users must be somewhat curtailed. The result is that the wildlife manager too frequently can satisfy no one entirely, and each special interest feels that it has been discriminated against.

Such circumstances are not new to foresters, but recently some changes have been made in forestry education in an effort to prepare foresters to better understand and meet such complications. One development has been that of forming, within a college or university, a department of Conservation, joining all the work in forestry, wood utilization, wildlife, fisheries and general conservation into one department. Specialized curricula are allowed in any one of these particular lines, but any specialist is encouraged to take enough courses in related curricula to broaden his appreciation.

Another idea, now a distinctive feature of the School of Forestry at the University of Minnesota, is a single course in Conservation of Natural Resources which is given to all students when they enter, either as freshmen or by transfer from another college. This course endeavors not merely to survey all natural resources but to establish in the student's mind some of the principles that govern all resource management. Like all generalizations these so-called principles must be applied with caution but they do seem to be of some assistance. What are these principles? Some are as follows:

(1) All resources are inter-related. (2) A resource is that which is useful to man, directly or indirectly. (3) Conservation is foresight. (4) The economic availability of natural resources is constantly changing. (5) All energy comes from the sun, therefore resources should be managed so as to make the most efficient use of the mechanisms by which this energy becomes available. (6) Each individual plant and animal can be understood only when its environment is understood. (7) Each watershed is an indivisible unit, and all resource management within that watershed must be coordinated to some extent. (8) Successful land management means getting each portion of land into the use for which it is best suited. (9) Wildlife management is essentially habitat management.

One thing which this conservation course helps to demonstrate to the students is the importance of social relationships. The man or woman working with any natural resource soon finds that he is working less and less with physical and biological problems and more and more with people. A recent survey of practicing foresters showed that the college training they considered most helpful to them was that in communication skills—speaking and writing. Rated closely after these and above many of the technical forestry courses and science courses were applied psychology, citizenship, and government. Many foresters have failed in a job because of inability to handle personnel and administrative problems. Very few have failed because of technical inabilities.

These, then, are the ways we are endeavoring in the field of forestry to develop in our graduates skill in coordinating forest management with the management of all natural resources:

A strong foundation in the natural sciences.

Training in related specialized fields.

An introductory course in the principles of natural resource management.

A broad training in communications and the social sciences.

Training in Wildlife Management

ROBERT A. McCABE

University of Wisconsin

A DEFINITION of wildlife management is not to be found in a dictionary. Before an attempt is made to define the term some pertinent background information may be of interest.

Wildlife management, from its inception in antiquity to the involved procedures of present-day English game keepers, has been considered an *art*. When our American wildlife resources became dangerously depleted, attempts were made to correct the situation by parroting European game methods. The result was failure. The wildlife literature of the 1930's is strewn with the wreckage of management programs. The single common denominator of most of our failures was that we did not understand our land or our animals, or the relationship between them. It is impossible to say where or when the rude awakening took place. This fact stands out—American wildlife management, to become a functioning entity, had to metamorphose from an *art* into a *science*.

In this metamorphosis, the first cracking of the inflexible integument of nonscientific management came in 1933 with Aldo Leopold's book, "Game Management." Wildlife research for the most part gravitated to academic surroundings where taxonomy, physiology, parasitology, chemistry, endocrinology, and a dozen other plant and animal sciences, plus geology, soils and meteorology, dealing with inorganic aspects of the environment, formed the foundation on which the research was built. Thus wildlife research was born of many sciences but claimed by none.

It soon became apparent that, although wildlife research could be observational, analytical, or experimental, the facts obtained could only benefit animals or environment when they clarified the relationship between the two. The die so cast led inevitably into the field of ecology. And here the old art of wildlife management emerged as the science of wildlife ecology.

This abbreviated version of the development of a science, leads to a definition of wildlife management as "the scientific manipulation of land, plants and/or animals in the best interests of the entire biota." This definition implies: (1) that land also includes all water resources; (2) "animals" includes man, and (3) that on occasion the best management may mean complete abstinence from manipulation.

The training of a wildlife ecologist must include two types of emphasis; one, the knowledge and resultant skills acquired from academic training; and, second, the understanding and acquisition of an ethical code and sense of esthetic values towards conservation as a whole.

Of the two, the latter is more difficult to instill, because these attitudes are largely self-taught. I wish I could give a formula or set of rules by which this end is accomplished, but this is impossible because there is none. The greatest wildlife teacher I ever knew (or hope to know) taught these attitudes by example. No one fortunate enough to fall under the influence of Aldo Leopold could fail to understand and appreciate the need for a high code of morality toward wild things.

There are three fundamental attitudes that I feel are essential to training in wildlife management. The first is the realization that animals as well as plants have their roots in the soil, and again that man is not exempt from this rootage. It must be realized that soil is not just dirt but the vital, life-giving substance that is the bone and body of our country. Second, that in wild places and wild things there can be seen a pattern of harmony and balance that must be preserved. Tampering or removing even one of the smallest parts of a series of biological systems may jam the larger gears. The starling that fouls our city streets and the carp that muddies our lakes are the results of such tampering. Third, that conservation includes the wise use of our resources. The failure to reduce deer herds in many states results in a loss of both deer and forests. Such flagrant misuse of resources is caused by an emotional blindness to an obvious remedial action.

In our economically minded society the *use* of a commercially important resource will gain ready acceptance. Its *wise use* may have to be fought for, often by those who stand to gain nothing personally. The willingness to fight on principle for wise utilization of our natural resources indicates a maturing of this third attitude.

I spoke about wildlife philosophy first because on it depends the way and the degree to which an education is used. Rather than discuss or compare the numerous academic programs for training wildlife ecologists I will explain how we operate at the University of Wisconsin. Our system may not be the best, but it has functioned successfully for the past twenty years.

We do not give an undergraduate degree in wildlife because: (1) we do not consider a properly balanced undergraduate course adequate as a terminal degree in so diverse a field; (2) every available class hour in the first four years should be devoted to the basic sciences of zoology, botany, chemistry, mathematics, etc., plus fulfilling those courses in the social sciences that the administration considers necessary for academic balance. A master's degree can be considered a terminal degree. It is made so because it is a research degree. A man possessing a master's degree is in a position to carry on research or undertake a management program for any agency or institution. This in turn may lead to an opportunity to do research for a Ph.D. The doctor's degree is given only as a joint major with some base science department such as zoology or botany. The Department of Wildlife Management agrees with Dr. Rudolph Bennit, who said of a Ph.D. candidate, he "should perform the most original, fundamental and highly technical work of which he is capable, leaving purely descriptive research largely to others."

All students with the proper qualifications are accepted, but only those with the highest grades and greatest field experience are given financial aid through university assistantships or grants. Other forms of financial help come through various conservation agencies through the granting of leaves-of-absence with whole or part salary, research stipends, or part-time employment. No student since the inception of the department in 1933 has ever, on his own, supported himself in both his campus education and his field research. The amount of outside financial help limits in part the number of graduate students that can be carried to an advanced degree. This is an oversimplification of the methods of our Department, but we have found that in general they have worked to the advantage of all concerned.

It goes without saying that education and a sound philosophy are necessary to a well-trained wildlife ecologist. It is equally important that the student possess a pleasing personality, strong physique and ingenuity to cope with difficult situations. His education should have awakened an unbiased inquiring mind . . . a trait commonly called the scientific attitude.

The ideally trained student from the standpoint of education and qualification may never be attained, but it should not be for lack of trying. Training in wildlife management must produce a thinker, a doer, and a leader in each student.

Preparation for Fishery Research and Management

KARL F. LAGLER

University of Michigan

THREE-FOURTHS of the earth's surface is covered with water. Most of this area is unexploited. The fisheries of the world are concerned with the harvesting of life from such seas and inland waters. Since fisheries deal with a renewable resource, it is the role of fishery scientists to attain maximum sustained yields by guarding against both over- and under-exploitation. It is also their duty to secure the most efficient utilization of the products harvested or their by-products.

In North America there are two great fisheries—sport and commercial—while in Asiatic countries, in contrast, because food is scarce, food-fish production and commercial fisheries are paramount. In the United States, it is estimated that there are more than 16 million sport fishermen. These sportsmen pay approximately $15 million per year for licenses and return approximately $5 million through federal excise taxes on fishing tackle. This income supports most of the requisite research and management. Because of this too, most fishery students find employment in government agencies, although positions are also available in the colleges and universities offering fisheries training, and with international commissions and private organizations.

The areas of professional specialization in which most men in fisheries are engaged are: (1) *Research*—in factors affecting abundance (classification, life history, and ecology of fish and other aquatic organisms) and experimentation in possible methods for improving or maintaining abundance. (2) *Management*—of fishery resources and fishermen (including the application of research results to the improvement of yields, pollution control, fishery engineering, and *very importantly* to public relations and conservation education). (3) *Agriculture*—the controlled production of fish for food, for sale, and for stocking public and private waters. (4) *Technology*—the utilization (preparation, processing, packaging, etc.) of fishery products as food, drugs, or as raw materials for industry. (5) *Economics*—the study of yields, values, holdings, marketing, exports and imports. (6) *Administration*—operations and integration of unit functions, fishery regulations, policy formation, legislative relations and education.

How can a student best train himself for one or more of these areas of fishery work? It would seem that, first, he should secure a sound liberal education and regard commencement at the end of four years in the exact sense of the word. He will major in science if he is interested in biological, managerial or technological fishery work, or in economics and business administration if he is most stimulated by business or administrative possibilities. In either situation, strength should be developed in communications—writing and speaking—because so much effort is ultimately spent, by all kinds of conservation workers, in dealing with people rather than with things.

Adequate undergraduate programs are probably offered by most of America's 1,500 colleges and universities but if possible the student should choose an institution where thought rather than rote learning is encouraged. With a properly broad undergraduate background gained, the student may then select the institution best fitted to develop him in the specialty he wishes to pursue. At the present time, although some sixty American colleges and universities offer some training in fishery work, only about a third of these offer adequate programs for graduate specialization.

When the prospective worker in fisheries has completed his training, he will find that his success will not be measured in the number of facts or pat answers that he has memorized but rather in the attitudes which he has developed, his ability to attack a problem and obtain results, and in his skill in making his findings and conclusions known to others. He will also find, as biologists in general have found, that his financial rewards are not great but that the satisfactions of a sincere resource worker are so manifold that they can never be measured by monetary means.

The teacher and the institution interested in training fishery workers have problems of immediate concern. Most of these problems relate to the quality of the product—the graduate trainee. One area of concern is the competition for good students between fields such as fisheries and other scientific professions. Work in fisheries is far from being as highly remunerative as that in physics, chemistry, engineering, and medicine. It is, therefore, becoming increasingly difficult to recruit high caliber men into the field.

Although there appears to be a drop in qualified recruits, the number of schools offering fish work continues to grow. From about 43 in 1940, there are now nearly 60 (1952). Unless further expansion along this line is discouraged, serious lowering of professional standards may ensue. It seems desirable for some organizations such as the American Fisheries Society to adopt an institutional accreditation procedure similar to that practiced now by the Society of American Foresters for forestry schools.

In most schools with fishery programs, a peculiar teaching problem exists. It has been found necessary to guard against over-specialization in the undergraduate years and to distinguish between "true research" and "data gathering" in all student problem work. Particular care must be exerted in these institutions to the development of attitudes. Perhaps this can best be accomplished by strict avoidance of proliferation of courses and course requirements and the provision of extended opportunity for reading, study, and critical discussion of the mounting monumental works in the field—not alone in fisheries, but in biology and all of science.

Necessity for Background Information in the Training of the Conservation Worker

WILLIAM H. MARSHALL

University of Minnesota

SOME years ago Aldo Leopold stated "Barring love and war, few enterprises are undertaken with such abandon, or by such diverse individuals . . . as that group of avocations known as outdoor recreations." He might have added, although in few if any other aspects of human endeavor does complexity and everlasting change play such a dominant part, almost nowhere else can one find more persons with such a bulldog tenacity for single schemes. Biology teachers have a vital role to play in harmonizing these components of the conservation movement.

To progress soundly we need an alert citizenry, capable of critical thinking and appreciative of not only the necessity for conservation but also the fact that various conservation needs are interwoven and changing. Actually, many adminis-

trators claim it is the public that requires the most skillful managing in the conservation field. The biology teacher can lay the cornerstone for future sound conservation work by instilling important background information into the minds of broad educational groups.

What is the important background information? I do not pretend to be able to answer this question categorically. However, three ideas appear to be fundamental: (1) Conservation means wise use of a whole series of natural resources that have many interrelationships and ramifications. (2) Natural resource problems are a constantly changing series of events. (3) Though there are complexities and changes, these can be understood by intelligent inquiry and influenced by skillful manipulation.

A lack of appreciation of these points develops the illusion that the application of some single technique, program or slogan will produce favorable results anywhere and at anytime. It may be that the "one stop service" slogan is a good one for gasoline stations or that repetition of singing commercials sells soap—but such an approach does not insure wise use of natural resources. Let us look at some examples of accepted slogans in relation to change in natural resource needs.

In wildlife management such techniques as predator control, refuge establishment, and artificial stocking have all had their day. Critical studies and field experience show that they have value only as special tools in some places or some occasions. The difficulty is that *instead of having a day they have had decades* in the minds of many and we often continue to use them as general management tools. In such cases, conservation funds are being needlessly wasted.

Let us look at current programs of fire-control. Nearly every conservation worker, professional or citizen, is committed to the slogan, "Keep . . . . . Green." However, times have changed since the early logging days when fire hazard conditions were at a maximum because of enormous quantities of slash, infrequent roads and poor communication. But what conditions have resulted from the tremendous decrease of fires? A recent article tells of the loss of a prime game bird, the sharp-tail grouse. Plants such as blueberries seem to be disappearing. Recent studies in Minnesota indicate that the highly prized stands of red pine developed as a result of fire, not in spite of it. Perhaps some rephrasing of the old slogan will have to be made.

Another simple slogan, "Good soil conservation is good wildlife management" bears scrutiny. Where cultivated fields are intermixed with a different land use, such as forestry or grassland economy, this slogan may be valid. But where soil conservation practices tend to produce large areas of mono-types the reverse may be true. Hedgerows, gullies, brush patches, potholes, and streambanks are often simply pushed aside, filled in, buried or drained with heavy bulldozers and machinery. Farm game usually suffers.

This discussion then turns into a plea to train conservation workers not in the technique, the slogan, or compilation of data but rather in the Teddy Roosevelt doctrine of conservation which recognized that: (1) Outdoors resources are an integral whole; (2) Conservation is a public responsibility with private ownership a public trust; (3) Science is the tool for discharging these responsibilities and trusts. This can only be accomplished through training that is broad in scientific background, clear in developing a concept of basic changes which go on daily, and strong in presenting ideas rather than catch-phrases.

There rests on the biology teacher the task of integrating the basic sciences with the "ecological conscience." Such a teacher will further the aims of conservation by stressing living aspects of field biology and by cultivating the state of mind which is in a friendly welcoming attitude toward change—in Kettering's words the "tomorrow mind" instead of the "yesterday mind."

Preparing Teachers of Conservation

RICHARD L. WEAVER
University of Michigan

BEFORE the training of conservation teachers is discussed, it would perhaps be useful to recognize some of the ways in which these persons first become interested in conservation and the methods by which this interest can be further fostered.

Certainly many persons first become interested in out-of-door study through the instruction of a very conscientious teacher in the elementary or secondary schools. Such a teacher, with an active science program or an extracurricular science club, often sparks the first interest. Youth programs featuring the outdoors, such as Boy Scouts, Girl Scouts, 4-H, and Future Farmers of America, also play an important part in future decisions to become a conservationist. Can you pinpoint your initial interest or did it stem from an early life on a farm, or just a love of the out-of-doors generally?

The answer to this question is an important one because only through the use of such information can youth leaders and teachers plan how best to recruit and train conservation-minded students.

Teachers, themselves, sometimes need stimulation to awaken an interest in conservation work. This stimulation may be received during a summer school course, through an in-service workshop, or by attending a summer nature camp or conservation laboratory. Professional conservationists may assist in this stimulation of teachers by serving as consultants for a school, leading field trips, or attending faculty meetings.

Important Elements in Conservation Training for Teachers

1. A primary criterion is that all information about resources be as accurate and up-to-date as possible. Since the field is one with few comprehensive texts, this requires extensive research into journals, books, references, governmental and organizational materials.

2. The scope of resources information should include non-renewable resources and human resources as well as the renewable natural resources. For too long conservation has been compartmentalized into water, soils, forests, and wildlife. Only inadequate references have been made to minerals, parks and recreational or scenic resources, political, economic and social applications of resource-use information, and the improvement of the standard of living of humans. This latter application is beginning to be recognized as the *most* important reason for conservation education. The inclusion and acceptance of courses in international resources problems, conservation of minerals, and an equal emphasis on the social, economic and political implications of conservation in college curricula in the natural sciences at such places as the University of Michigan and Yale, is a good sign and an important milestone.

3. First-hand experiences should take precedent over vicarious ones. Ever since the teachings of Louis Agassiz, Liberty Hyde Bailey and Anna Botsford Comstock, the value of outdoor instruction and interpretation has grown in emphasis in conservation training. Laboratory experimentation, library research and class discussion, however, should never be minimized as important components of this same training. But "field schools," such as Cornell University and the University of Michigan, hold high priority.

4. It is generally accepted that a conservationist should have a rather complete working knowledge of the flora and

fauna, the soils, water and minerals, and of man himself, and that he be familiar with the life histories, the distribution and the economic importance of all things that he must manage and conserve. This understanding, while never complete, must be such that he can undertake independent investigations in any part of the country. Actually this knowledge should be equally useful if the conservationist is transferred to another country where a totally unfamiliar situation exists.

5. A basic understanding of the ecological relationships of all resources, natural, human and social, is also an important element of a training program.

6. Conservationists must be able to devise over-all and specific plans of action in investigating the particular resource problem of a community. A knowledge of people, economics and government, and of politics is essential in the application of scientific knowledge to the real problems of a particular situation. This often requires a combination of the scientific method, specific local understanding and the considered judgment of experienced individuals.

7. A facility for extemporanous speaking, the ability to make effective presentations by radio and television, and skill in writing for newspapers, magazines and scientific journals, are all important assets to a conservationist.

8. Whether a teacher or not, a conservation worker should make good use of the most up-to-date audio-visual materials and techniques. This requires continuous appraisal and use.

9. The ability to lead field trips, organize expeditions, plan and execute field investigations is a "must." This requires a series of experiences which build up a trainee confidence in "doing" rather than "talking about."

10. A new and recently recognized criterion for the conservationist is that of understanding how people work and live together. Group dynamics needs to be understood, perfected and applied if students or laymen are to become effective leaders or followers. In some schools this need has been recognized and programs of instruction set up that utilize the cooperation of Schools of Education and Departments of Psychology.

11. Teachers, specifically, must be able to plan, organize and execute effective units of instruction in conservation, into which all or many of the above components fit. These units of work or curriculum programs allow for the close cooperation of various teachers and departments and build an integrated program with each department or teacher feeling a special responsibility and opportunity to teach the important aspects of conservation in which he is or should be most interested and best qualified.

Many colleges will have to revaluate their present programs if some or most of the above criteria are accepted as necessary elements of an effective training program in conservation. Also, it will be necessary to combine our knowledge of resources with effective means of communication and teaching if our ideals and philosophies are to become generally accepted by the laymen, the administrator and the policy maker.

International Union of Biological Sciences

XIth General Assembly

Nice, France, August 17-21, 1953

THIS meeting was marked by a crucial reorganization and implementation of the Union. Policies were broadened; new programs outlined; the administrative machinery simplified; new personnel elected in the interest of rotation; a "bicameral" system instituted by the creation of a scientific Policy Board to supplement the administrative Bureau; a campaign to increase membership and to raise dues and contributions was inaugurated; and a number of new projects of practical significance undertaken. The U. S. delegation consisted of: Paul Weiss, Chairman, Ralph E. Cleland and Bentley Glass. Countries represented at the Assembly were: Australia, Austria, Belgium, Denmark, France, Great Britain, Israel, Italy, Japan, the Netherlands, Sweden, Switzerland, United States of America, and Yugoslavia. Countries that had announced participation, but whose delegates did not arrive included: China, Egypt, and Spain. Observers were present from Germany, not yet formally admitted to membership, and from Brazil, in undefined status because of nonpayment of dues. Sections represented were: Biometry, Botany, Cell Biology, Embryology, Entomology, Genetics, Limnology, Microbiology, and Zoology.

It was decided by a majority vote to remove the executive offices from Paris to Italy. The following officers were elected: President: Sven Horstadius (Sweden); Vice-President: Ralph E. Cleland (U. S. A.); General Secretary: G. Montalenti (Italy); Secretary: R. Ulrich (France); Treasurer: A. Linder (Switzerland).

In order to help provide funds for the contemplated broadening of the program of IUBS, each national delegation was instructed to urge, through its national committee, that the country contribution to IUBS be raised at least fivefold. Solicitation of applications for membership by countries not yet adhering was approved. Germany was specially invited to apply. South American participation was confined to Argentina, Brazil, Colombia and Peru. It was decided to keep the unit of contribution low (200 Swiss francs) in order to bring it within the means of all countries to join and take an equal share in the activities and benefits.

Three special conferences on scientific subjects during each of the next three years were approved for sponsorship and subsidy by IUBS, one on an embryological topic to be held in U. S. A. in 1955.

Dr. Bentley Glass was elected Chairman of a new international committee with power to investigate and recommend improved procedures for more methodical communication and coordination in the abstracting of biological world literature.

Two resolutions, introduced by the U. S. delegation, were adopted. "In view of the urgent need for facilitating international information and exchange of biological materials (animals, plants, cultures, preparations, etc.) for purposes of research, testing, assaying and teaching, the Bureau is directed to recommend measures by which the various national services already concerned with the problems of biological supplies could be brought into closer cooperation and their transnational activities facilitated (e.g. shipping and quarantine regulations, certification, international registry, etc.) and such services be inaugurated in countries where they are not yet in existence." "In view of the rapidly increasing danger to crop plants from foreign pathogens inadvertently introduced by the growing volume of air traffic, it is imperative that large-scale studies on an international level be undertaken to encompass the whole field of plant pest caused by microbial, plant and animal vectors. The Bureau is therefore directed to explore the problem and to initiate appropriate machinery for the correlation and coordination of the various national attacks on this problem."

IX International Genetics Congress

Bellagio, Italy, August 24-31, 1953

Richard B. Goldschmidt, President

THE Ninth International Genetics Congress met in late August 1953 at Bellagio, on Lake Como. Perhaps no Genetics Congress has ever met in a more scenic spot with such pleasant surroundings. Our Italian colleagues were genial hosts and had planned everything well, including the entertainment with visits to some of the villas on the banks of Lake Como. The guests were housed at hotels in Bellagio, and on the opposite side of the lake in Tremezzo, Cadenabbia, and Menaggio. Free ferry service was provided for guests living on the opposite side of the lake. One of the most enjoyable features of the Congress was an excursion to Lugano, Switzerland, on Thursday, August 27.

The Congress was opened with an address by the President, Dr. Richard B. Goldschmidt, on Monday morning, August 24. His topic was "Different Philosophies of Genetics." On Monday afternoon began the first of the plenary sessions of the Congress. On successive afternoons the Congress members assembled in the Ball Room of the Hotel Villa Serbelloni for additional plenary sessions. The speakers were as follows:

Monday—E. B. Lewis, K. Mather and I. M. Lerner. *Tuesday*—R. Dulbecco, G. Pontecorvo, M. Demerec, H. Stubbe. *Wednesday*—A. Câmara, T. Oksala, A. Müntzing, R. Matthey. *Thursday*—Excursion to Lugano, Switzerland. *Friday*—T. M. Sonneborn, C. Stern, E. Hadorn, C. Barigozzi. *Saturday*—Th. Dobzhansky, A. A. Buzzati-Traverso, E. B. Ford, J. Clausen. *Sunday*—L. S. Penrose, T. Sjögren, B. Glass, G. Montalenti. *Monday* (a.m.)—J. L. Lush, F. G. Brieger, O. H. Frankel.

In addition there were talks by invited speakers interspersed through the morning program of short papers, so scheduled that no two were given at the same hour. Invitation speakers for these programs were: H. Nachtsheim, L. C. Dunn, E. Caspari, R. A. Fisher, C. H. Waddington, C. Jucci, A. Gustafsson, C. Gini, C. D. Darlington, H. Grüneberg, L. Gianferrari, J. B. S. Haldane, and A. Chiarugi.

The morning sessions, except the first and last day, were devoted to short papers which were presented in rooms either in the Hotel Grande Bretagne (the headquarters of the Congress) or at the Bellagio Communal School, about ½ mile distant. Free bus transportation was provided for Congress members between the two meeting places. Due to the large number of papers submitted, it was necessary to have eight different sessions running concurrently. The eight sessions were divided along lines of interest into the following subjects: Human genetics, Animal genetics, Cell Physiology, Evolution, Cytology, Mutation, Plant genetics and Applied genetics. Papers on these subjects were given at successive morning sessions. In addition to these eight sessions running simultaneously, there were also demonstrations on display at the Bellagio School.

The big social occasion of the Congress was the semi-formal dinner at Villa Olmo in Como on Saturday, August 29. A boat took Congress members from Bellagio, Menaggio, Cadenabbia and Tremezzo to the Villa Olmo dock, a pleasant ride of more than an hour. This dinner was a most enjoyable occasion.

Plans for the next International Genetics Congress were made at a plenary session, Sunday, August 30. An invitation for the Congress to meet in Canada was extended by the Genetics Society of America and by McGill University in Montreal. Before these invitations were presented on the floor of the Congress, a significant resolution was proposed by Dr. F. Baltzer, Switzerland. This resolution read, "The Congress asks the International Committee not to recommend that the next Congress be held in any country to which it may be expected that scientists would be refused permission to enter on grounds of race, nationality, religion, place of birth, or political associations past or present."

The resolution was adopted unanimously. Its meaning needs no elaboration. Because of expected difficulties of foreign scientists obtaining entry into this country, the Genetics Society of America, at its meeting in 1952 at Cornell, had voted to extend an invitation to the next Congress to meet in Canada. Other International Congresses are following a similar course. Until our immigration laws are changed, it will be impossible to hold a really International Congress in this country.

The IX International Genetics Congress ended Monday noon, August 31. Nearly 900 scientists from all over the world, with the exception of the Iron Curtain countries, had attended the meeting. The United States was well represented with approximately 150 geneticists. No attempt is made here to even abstract any of the papers. Abstracts will be found in the Proceedings of the Congress, to be published shortly.

W. RALPH SINGLETON.

Private Bibliographies

A questionnaire was published in two recent issues of the *AIBS Bulletin*, requesting information about private bibliographies. That the information submitted may reach all interested persons, a list of these private collections appears below. This list is not complete. The remainder will appear in the April *Bulletin*.

PLANT SCIENCE

1. MEXICAN FLOWERING PLANTS. Ida K. Langman, Academy of Natural Sciences, Philadelphia 3, Pa. Period: 1519-1950. Approx. 6500 references. Inclusive except plant phytology. Annotated. May be seen at address.

2. LILIES. George L. Slate, New York State Agricultural Experiment Station, Geneva, N. Y. Period: 1840 to date. Inclusive. No geographic limitation. Unannotated. May be seen at address.

3. COMMERCIAL UTILIZATION OF SEAWEEDS. Evelyn M. Campbell (Librarian) and D. C. West (Translator), Nova Scotia Research Foundation, P. O. Box 1027, Halifax, Nova Scotia, Canada. Approx. 150 references. Inclusive. No geographic limitation. Annotated. May be seen.

4. BRYOPHYTES (HEPATICAE, MOSSES). Margaret Fulford, Dept. of Botany, University of Cincinnati, Cincinnati 21, Ohio. Approx. 10,000 author references, 30,000 others. Inclusive. No geographic limitations. Annotated in part. May be seen.

5. TRANSPIRATION RATIO OF PLANTS. Lowell F. Bailey. Botany Department, University of Arkansas, Fayetteville, Ark. Period: 1699-1940. Approx. 175 references. Inclusive. No geographic limitation. Partially annotated. May be seen.

6. PHOTOSYNTHESIS. H. A. Spoehr, Dept. of Plant Biology, Carnegie Institution, Stanford, California. Period: 1870 to date. Approx. 4,000 references. Inclusive. No geographic limitation. Unannotated. May be seen.

7. PLANT ECOLOGY. Henry J. Oosting, Dept. of Botany, Duke University, Box 6875, College Station, Durham, N. C. Period: 1900 to date. Approx. 14,000 references. Selective for geography and synecology. Not geographically limited but with N. A. emphasis. Partially annotated. May be seen.

8. DROUGHT RESISTANCE IN PLANTS. Paul A. Fryxell, Dept. of Agronomy, State College, New Mexico. Period: 1920-1952. Approx. 350 references. Inclusive. Not geographically limited. Two-thirds abstracted. May be seen.

9. NATURAL VEGETATION OF EASTERN ASIA (I. FORESTS. II. GRASSLAND and DESERT). Wang Chi-Wu, Harvard Forest, Harvard University, Petersham, Mass. Period: 1900 to date. Approx. 2,000 references. Selective. Unannotated. Could probably be seen.

10. BLUE-MOLD (PENICILLIUM EXPANSUM) DECAY OF APPLE. Kenneth F. Baker, Dept. of Plant Pathology, University of California, 405 Hilgard Avenue, Los Angeles 24, California. Period: to 1934. Approx. 700 references. Selective. Annotated. May be seen.

11. DISEASES OF ORNAMENTAL PLANTS. Kenneth F. Baker, Dept. of Plant Pathology, University of California, 405 Hilgard Avenue, Los Angeles 24, California. Period: to date. Approx. 40,000 references. Inclusive. No geographic limitations. Annotated. May be seen.

12. ARCTIC BOTANY. Nicholas Polunin, Gray Herbarium of Harvard University, 79 Garden Street, Cambridge 38, Mass. Period: to date. Approx. 10,000 references. Generally inclusive. Geographically limited to Arctic and Subarctic. Unannotated. Probably can be seen.

13. SYSTEMATIC BOTANY. C. L. Porter, Rocky Mountain Herbarium, University of Wyoming, Laramie, Wyoming. Period: 1800 to date. Approx. 6,000 references. Selective. Geographically limited to Boreal, Arctic, Alpine and Western North America. Annotated to some extent. May be seen.

14. PLANT VIROLOGY. H. H. Thornberry, Dept. of Horticulture, University of Illinois, Urbana, Ill. Period: 1900 to date. Approx. 3,800 references. Inclusive. Not geographically limited. Annotated. May be seen.

15. AMERICAN BOTANICAL COLLECTORS. Rogers McVaugh, Herbarium, University of Michigan, Ann Arbor, Michigan. Period: 1600-1900. Approx. 1,000 references. Inclusive. Geographically limited to Western Hemisphere. May be seen.

16. THE CUCURBITACEAE (Genus LACTUCA). Thomas W. Whitaker, U. S. Horticultural Field Station, La Jolla, California. Period: since 1900. Approx. 1,500 references. Inclusive. No geographic limitations. Unannotated. May be seen.

17. TREE SEEDS. Henry I. Baldwin, Fox Research Forest, Hillsboro, New Hampshire. Period: to 1942. Approx. 2,000 references. Inclusive. Geographically limited to the temperate zone. Partially annotated. May be seen.

18. BROAD COVERAGE PLANT VIRUSES. Warren N. Stoner, Everglades Experiment Station, Belle Glade, Florida. Period: 1930 to date. Approx. 1,000 references. Inclusive. No geographic limitations. Partially annotated. May be seen.

19. FRESHWATER ALGAE OF SOUTHEASTERN U. S. Herman Silva, Dept. of Botany, University of Tennessee, Knoxville, Tenn. Period: to 1948. Approx. 70 references. Selective. Unannotated. Available in manuscript (thesis) at Michigan State College Library (1948).

20. GYMNOSPERMS (FERNS, LYCOPSIDA, SPHENOPSIDA, PSILOPSIDA, PALEOBOTANY). Herbert M. Clarke, Dept. of Botany, University of Wisconsin, Madison, Wisc. Period: 1850 to date. Approx. 7,000 references. Inclusive on subjects. Predominantly American at present time. Unannotated. May be seen.

21. EDIBLE FRUITS, NUTS, SEEDS, FLOWERS AND BUDS OF THE WORLD. Reid M. Brooks, Dept. of Pomology, University of California, Davis, California. Period: to date. Approx. 700 references. Inclusive. Not geographically limited. Partially annotated. May be seen.

22. VEGETATION. Frank E. Egler, Aton Forest, Norfolk, Connecticut. Period: to date. Inclusive. Continental U.S.A. Partially annotated. May be seen (with reservations).

23. CRANBERRIES. Frederick B. Chandler, Cranberry Station, East Wareham, Massachusetts. Period: 1847-1952. Approx. 2,200 references. Inclusive. Not geographically limited. Unannotated. Is in preparation for a Mass. Agric. Exp. Station Bulletin. May be seen.

24. FUNGICIDES. James G. Horsfall, Connecticut Agricultural Experiment Station, P. O. Box 1106, New Haven 4, Conn. Period: to date. Approx. 3,000 references. Selective. Not geographically limited. Annotated. May be seen.

25. BRYOPHYTES. Paul D. Voth, Dept. of Botany, University of Chicago, Chicago 37, Ill. Period: 1700 to date. Approx. 9,000 references. Inclusive. Not geographically limited. May be seen.

26. PTERIDOPHYTES. Paul D. Voth, Dept. of Botany, University of Chicago, Chicago 37, Ill. Period: 1700 to date. Approx. 8,000 references. Inclusive. May be seen.

27. NEW ZEALAND BOTANY. Robert Cecil Cooper, Auckland Museum, P. O. Box 9027, Newmarket, New Zealand. Period: to 1950. Approx. 3,000 references. Inclusive. Limited to New Zealand and its islands. Annotated. An index exists. May be seen.

28. TREE DISEASES (DECAYS AND STAINS IN WOOD). John S. Boyce, Osborn Botanical Laboratory, Yale University, New Haven, Conn. Period: 1880 to date. Approx. 30,000 references. Inclusive. Not geographically limited. Unannotated. May be seen.

29. GRASS VIRUSES. Webster H. Sill, Jr., Dept. of Botany and Plant Pathology, Kansas State College, Manhattan, Kansas. Period: 1920 to date. Approx. 150 references. Selective. Limited to North America. Partially annotated. May be seen.

30. FLORIDA PLANTS. Ruth S. Breen, Dept. of Botany, Florida State University, Tallahassee, Florida. Period: 1900 to date. Approx. 300 references. Selective: mainly taxonomic. Limited to Florida. Unannotated. May be seen.

31. SPERMATOPHYTES OF GEORGIA. Haskell Venard, 3959 N. Stratford Road, N. E., Atlanta, Georgia. Period: 1740-1953. Many thousands of references. Inclusive. Limited to Georgia. Unannotated. Arrangements could be made to use the bibliography in the library of Emory University.

32. FLAX. Arnold A. Wellwood, Dept. of Botany, Ontario Agricultural College, Guelph, Ontario, Canada. Period: 1900-1948. Approx. 650 references. Selective for flax diseases (fiber flax). Limited to North America. Unannotated. May be seen.

33. PHYCOLOGY. William Randolph Taylor, Dept. of Botany, University of Michigan, Ann Arbor, Mich. Period: indefinite but to date. Approx. 12,000 references. Inclusive. Not geographically limited. Partially annotated. May be seen.

34. LICHENOLOGY. Emanuel D. Rudolph, Dept. of Botany, Washington University, St. Louis 5, Missouri. Period: late 1800's to date. Approx. 2,000 references. Inclusive. Not geographically limited. Unannotated. May be seen.

35. SEED PHYSIOLOGY (MORPHOLOGY AND ANALYTICAL PROCEDURES). Lela V. Barton, Boyce Thompson Institute for Plant Research, Inc., 1086 North Broadway, Yonkers 3, N. Y. Period: to date. Approx. 50,000 references. Inclusive. Not geographically limited. Partially annotated. May be seen.

ANIMAL SCIENCES

1. THE GOLDEN HAMSTER (MESOCRICETUS AURATUS AURATUS). Hulda Magalhaes, Box 496, Biology Department, Bucknell University, Lewisburg, Pa. Period: 1839 to date. Approx. 850 references. Inclusive. Not geographically limited. Unannotated. An index is in preparation. May be seen.

2. HISTORY OF DOMESTIC ANIMALS. J. N. Spuhler, Institute of Human Biology, University of Michigan, Ann Arbor, Mich. Period: 1700 to date. Approx. 1,200 references. Inclusive. Not geographically limited. Unannotated. May be seen.

3. HUMAN BIOLOGY. J. N. Spuhler, Institute of Human Biology, University of Michigan, Ann Arbor, Mich. Period: 1900 to date. Approx. 4,000 references. Selective. Not geographically limited. Unannotated. May be seen.

4. HUMAN GENETICS. J. N. Spuhler, Institute of Human Biology, University of Michigan, Ann Arbor, Mich. Period: 1900 to date. Approx. 10,000 titles. Inclusive, except for medical genetics. Not geographically limited. Unannotated. May be seen.

5. AVIATION AND MILITARY OPHTHALMOLOGY AND VISUAL SCIENCES. Conrad Berens and L. Benjamin Sheppard, The Biological Sciences Foundation, Ltd., 1011 New Hampshire Avenue, N. W., Washington 8, D. C. Period: 1800 to 1945. Approx. 6,660 references. Selective. Not geographically limited. Annotated. May be seen.

6. CELL DIVISION. Ivor Cornman, 1339 H Street, N. W., Washington 5, D. C. Period: to date: Approx. 10,000 references. Selective for experimental agents. Not geographically limited. Annotated. Probably can be seen.

7. NORTH AMERICAN SALAMANDERS. Sherman C. Bishop and Arnold B. Grobman, Florida State Museum, Gainesville, Florida. Period: 1700 to date. Approx. 1,000 references. Inclusive. Limited to U. S. A. and Canada. Annotated. May be seen.

8. INBRED STRAINS OF MICE. Joan Staats and Elizabeth S. Russell, Library, Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Maine. Period: 1915 to date. Approx. 4,000 references. Inclusive. Not geographically limited. Unannotated. May be seen.

9. PIGEONS AND DOVES. W. F. Hollander, Genetics Department, Iowa State College, Ames, Iowa. Period: to date. Approx. 2,000 references. Inclusive. Not geographically limited. Unannotated. May be seen.

10. MYXOSPORIDIA AND MICROSPORIDIA. R. R. Kudo, 322 Natural History Building, University of Illinois, Urbana, Ill. Period: 1880 to date. Approx. 300 references. Inclusive. Not geographically limited. May be seen.

11. EMBRYOLOGY OF FISHES. Archie N. Solberg, Dept. of Biology, University of Toledo, Toledo 6, Ohio. Period: 1850-1953. Approx. 3,000 references. Inclusive. Not geographically limited. Annotated. May be seen.

12. PHYSICAL AND CHEMICAL PROPERTIES OF INSECT BLOOD. John Buck, National Institutes of Health, Bethesda 14, Md. Period: to date. Approx. 400 references. Inclusive. Not geographically limited. Partially annotated. May be seen.

13. ANATOMY AND PHYSIOLOGY OF FIREFLIES. John Buck, National Institutes of Health, Bethesda 14, Md. Period: to date. Approx. 300 references. Inclusive. Not geographically limited. Partially annotated. May be seen.

14. GAS EXCHANGE IN INSECTS. John Buck, National Institutes of Health, Bethesda 14, Md. Period: to date. Approx. 1,000 references. Inclusive. Not geographically limited. Partially annotated. May be seen.

15. PARASITOLOGY. Norman D. Levine, College of Veterinary Medicine, University of Illinois, Urbana, Ill. Period: 1900 to date. Approx. 12,200 references. Not geographically limited. Annotated. May be seen.

16. COMPARATIVE ANATOMY OF VERTEBRATES (OSTEOLOGY). C. L. Camp and J. S. Kingsley, 320 Hearst Mining Building, University of California, Berkeley, Calif. Period: 1500 to date. Approx. 25,000 references. Inclusive. Not geographically limited. Partially annotated. May be seen.

17. FRESHWATER TRICLADS (TRICLADIDA, PALUDICOLA, TURBELLARIA). Roman Kenk, 810 Ramsey Street, Alexandria, Virginia. Period: to date. Approx. 2,000 references. Inclusive. World-wide. May be seen.

18. BACTERIAL CYTOLOGY AND ELECTRON MICROSCOPY. A. Eisenstark, Dept. of Bacteriology, Kansas State College, Manhattan, Kansas. Period: to date. Approx. 1,000 references. Not geographically limited. Partially annotated. May be seen.

19. CHONDRODYSPLASIA (CHONDRODYSTROPHY, ACHONDROPLASIA, MICROMELIA, PHOCOMELIA). Walter Landauer, Atwater Laboratory, University of Connecticut, Storrs, Conn. Period: to date. Approx. 2,000 references. Inclusive. Not geographically limited. Unannotated. May be seen.

20. INVERTEBRATE PHOTORECEPTORS. Lorus J. Milne, Zoology Department, University of New Hampshire, Durham, N. H. Period: to date. Approx. 3,800 references. Not geographically limited. Annotated. Index in preparation. May be seen.

21. PROTOZOOLOGY (GENUS CRYPTOBIA). Max Katz, Environmental Health Center, U. S. Public Health Service, 1014 Broadway, Cincinnati, Ohio. Period: 1850 to date. Approx. 50 references. Inclusive. Not geographically limited. Unannotated. May be seen.

22. HEMATOLOGY OF TELEOST FISH. Max Katz, Environmental Health Center, U. S. Public Health Service, 1014 Broadway, Cincinnati, Ohio. Period: 1850 to date. Approx. 200 references. Selective. Not geographically limited. Unannotated. May be seen.

23. TOXICITY OF CHEMICALS AND INDUSTRIAL WASTES TO FISH. Peter Doudoroff and Max Katz, Environmental Health Center, U. S. Public Health Service, 1014 Broadway, Cincinnati, Ohio. Period: 1900 to date. Approx. 1,000 references. Inclusive. Partially annotated. May be seen.

24. GENETIC LINKAGE IN MAN. H. Warner Kloepfer, Dept. of Anatomy, Tulane University, New Orleans 18, La. Period: 1920 to date. Approx. 112 references. Inclusive. Not geographically limited. Partially annotated. May be seen.

25. AGING. Nathan W. Shock, Baltimore City Hospitals, Baltimore 24, Md. Period: 1900 to date. Approx. 20,000 references. Inclusive. Not geographically limited. Partially annotated. May be seen.

26. CROCODILIA. Albert M. Reese, Professor Emeritus, West Virginia University, Morgantown, W. Va. Period: 1870 to date. Approx. 260 references. Inclusive. Not geographically limited. Unannotated. May be seen. Could correspond.

27. BIOLOGY OF PARAMECIUM. Ralph Wichterman, Biology Department, Temple University, Philadelphia 22, Pa. Period: 1674 to date. Approx. 2,000 references. Inclusive. World-wide. Complete bibliography may be found in author's book "The Biology of Paramecium." (Blakiston)

28. ANATOMY OF HAIR. William V. Mayer, Dept. of Zoology, University of Southern California, Los Angeles, Calif. Period: 1773 to date. Approx. 3,000 references. Inclusive. Not geographically limited. Partially annotated. May be seen.

29. ANATOMY AND BIOLOGY OF MAMMALS: OF REPTILES. D. Dwight Davis, Division of Anatomy, Chicago Natural History Museum, Chicago 5, Ill. Period: 1875 to date. Approx. 15,000 author cards, 10,000 index entries. Inclusive. Not geographically limited. Annotated. May be seen.

30. DISEASES OF WILD BIRDS AND MAMMALS. Patricia O'Connor Halloran, Staten Island Zoo, 614 Broadway, Staten Island 10, N. Y. Period: 1830-1952. Approx. 8,500 references. Inclusive. Not geographically limited. Annotated. May be seen.

31. BOMBYLIIDAE (DIPTERA). Ralph B. Priddy, Dept. of Biological Sciences, University of Pittsburgh, Pittsburgh 13, Pa. Period: 1904 to date. Approx. 400 references. Inclusive. Not geographically limited. Partially annotated. May be seen.

32. CYTOLOGY AND GENETICS (OTHER BIOLOGY). C. L. Huskins, Dept. of Botany, University of Wisconsin, Madison, Wis. Period: to date. Approx. 15,000 references. Inclusive. Not geographically limited. Partially annotated. May be seen.

33. HIBERNATION. Raymond J. Hock, Arctic Health Research Center, U. S. P. H. S., Box 960, Anchorage, Alaska. Period: 1550 to date. Approx. 2,000 references. Inclusive. Not geographically limited. Unannotated. May be seen.

34. ZOOLOGICAL EXPLORATION. James A. Peters, Dept. of Biology, Brown University, Providence, Rhode Island. Period: 1700 to date. Approx. 400 references. Inclusive. Primarily concerned with the New World. Partially annotated. May be seen.

35. HERPETOLOGY OF ECUADOR. James A. Peters, Dept. of Biology, Brown University, Providence, R. I. Period: to date. Approx. 500 references. Inclusive. Limited to Ecuador. Annotated. May be seen.

36. SOFT-SHELL CLAM (MYA ARENARIA), HARD-SHELL CLAM (VENUS MERCENARIA). Clam Investigations, U. S. Fish and Wildlife Service, Boothbay Harbor, Maine. Period: 1807 to date. Approx. 750 references. Selected. Not geographically limited. Annotated. Bibliography in preparation. May be seen.

37. ECOLOGY OF ESTUARIES. Melbourne R. Carriker, Zoology Department, Rutgers University, New Brunswick, New Jersey. Period: 1900-1950. Approx. 2,720 references. Selective. Limited to Middle Atlantic States. Unannotated. May be seen.

38. CLASS: ASTEROIDEA (PHYLUM: ECHINODERMATA) Frederick A. Aldrich, Dept. of Zoology, Rutgers University, New Brunswick, New Jersey. Period: 1926 to date. Approx. 400 references. Inclusive. Not geographically limited. Partially annotated. May be seen.

39. HOMOPTERA: AUCHENORHYNCHA. Z. P. Metcalf, Gardner Building, North Carolina State College, Raleigh, N. C. Period: 1758 to date. Approx. 12,000 references. Inclusive. Not geographically limited. Annotated. May be seen.

40. POISONOUS AND VENOMOUS MARINE ANIMALS OF THE WORLD. Bruce W. Halstead, School of Tropical and Preventative Medicine, Loma Linda, California. Period: 1500 to date. Approx. 1,200 references. Inclusive for fish: selective for invertebrates. Not geographically limited. Annotated. May be seen, especially by Armed Forces.

41. PRIMATES. Theodore C. Roch, Dept. of Physiology and Biophysics, University of Washington School of Medicine, Seattle, Wash. Period: 1939 to date. Approx. 3,500 references. Inclusive. Not geographically limited. May be seen. Information will be sent by mail.

42. BLOOD CLOTTING. Louis B. Jaques, Department of Physiology, University of Saskatchewan, Saskatoon, Sask. Period: 1900 to date. Approx. 9,000 references. Inclusive. Not geographically limited. Unannotated. May be seen.

43. HEPARIN. Louis B. Jaques, Department of Physiology, University of Saskatchewan, Saskatoon, Sask. Period: 1900 to date. Approx. 3,600 references. Inclusive. Not geographically limited. May be seen.

44. NAMED GENES OF MUS MUSCULUS. George D. Snell, Jackson Memorial Laboratory, Bar Harbor, Maine. Period: 1909 to date. Approx. 600 references. Inclusive. Not geographically limited. Partially annotated. May be seen.

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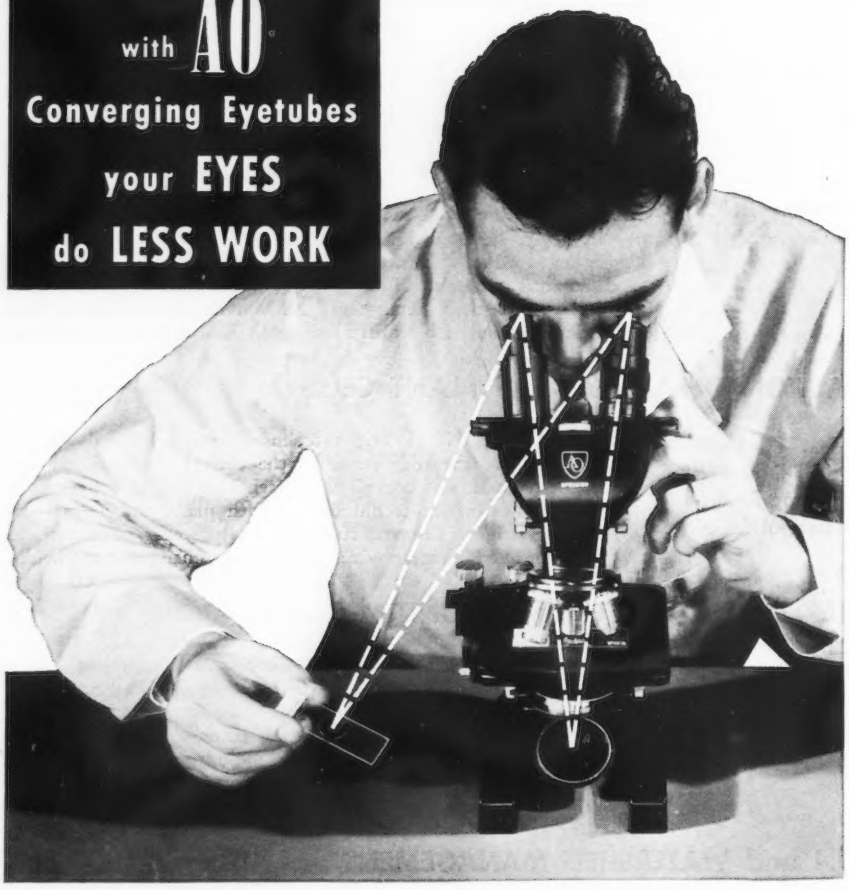

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